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Cost of Pig Iron Made from Lake Superior Ores

Broad General Costs Considered; Operations of Steel Corporation Taken as Representative. Mining Less Expensive Than Transporting the Ore

BY J. R. FINLAY*

The iron ores of the Lake Superior region are the richest in the world, and it is probable that the 400,000,000 tons shipped up to the present time have averaged 60 per cent. in metallic iron per ton of dry ore. Some cargoes have run as high as 68.5 per cent. When you remember that these ores are hematite and that pure hematite is only 70 per cent. iron, you realize that they are exceptionally pure natural concentrates, indeed purer than most artificial concentrates.

When people speak of the output of metal mines in general they mean the gross selling value of the refined metals at New York. Now the value of Lake Superior iron ores is never in mass. You hear of the value of bessemer, or non-bessemer, old range or Mesabi ores at the mines or at Cleveland, but you do not hear of average values nor of gross values in pig iron.

Output of Various Mining Districts

To get a sense of proportion let us calculate the metal-selling value at New York of the annual output of some of the greatest mining districts for an average of five years: Cripple Creek, gold, $12,000,000; Transvaal, gold, $94,860,000; Butte, copper, silver and gold, $48,000,000; Cœur d'Alene, lead-silver, $13,000,000; Joplin, zinc and lead, $16,300,000; Lake Superior, iron, $490,000,000.

The business is profitable, one of the most profitable in the world, but it is not easy to give precise figures concerning it. Much has been written on the various problems involved, such as the caving system of mining, the systems of accounting, mining in open pits, blast-furnace practice, etc., but each of these is only a link in the chain. I have never found any comprehensive discussion of the subject as a whole. I have, therefore, endeavored to work out on an original basis a statement of the cost of operating this vast business. It may be interesting to explain the method.

General Costs

The first thing to decide is what to include in the cost. At present, it is not a matter of any particular interest to have details of the mere cost of extracting ore from some particular iron mine and dumping it on the surface, although before the absorption of most of the mines by the various steel and furnace corporations the local mining costs were indeed a subject of interest. There were then many companies which only mined the ore and sold it at the pit mouth.

At the present time by far the greater part of the ore is mined by concerns which use it to make pig iron and in many cases, finished manufactured steel or iron products. To describe this industry in parallel terms to those used in the case of other metals it seems to me that we should find the cost of pig iron delivered at New York. It is quite true that New York is not the greatest market for pig iron, but since I have discussed other metals on the theory of their delivery there it is reasonable to follow the same plan with iron.

The reason for stopping with the production of pig iron is simply the analogy of other metals. Pig iron is the basic commodity of iron manufacture. It bears the same relation to the making of steel rails or pocket knives, as electrolytic-copper bars bear to the making of copper wire or brass door knobs, or as pig lead bears to lead pipe or buck-shot. I have tried to show what it costs to produce from various districts copper, lead and zinc ready for manufacture so I shall try to show the cost of bringing Lake Superior iron to the same stage.

Complexities of the Problem

When we give this problem some attention we soon find it rather complex. The ore comes from scores of different mines, each producing its own particular grade at its own particular cost. But the cost of getting ore out of the mine is considerably less than that of transporting the ore from the mines to the furnaces, although the cost of transportation varies considerably according to the situation of the mine. We find that in some cases large royalties are paid to fee owners and in other cases the mining company owns the ground. These various factors are bewildering. Furthermore none of the companies gives its costs.

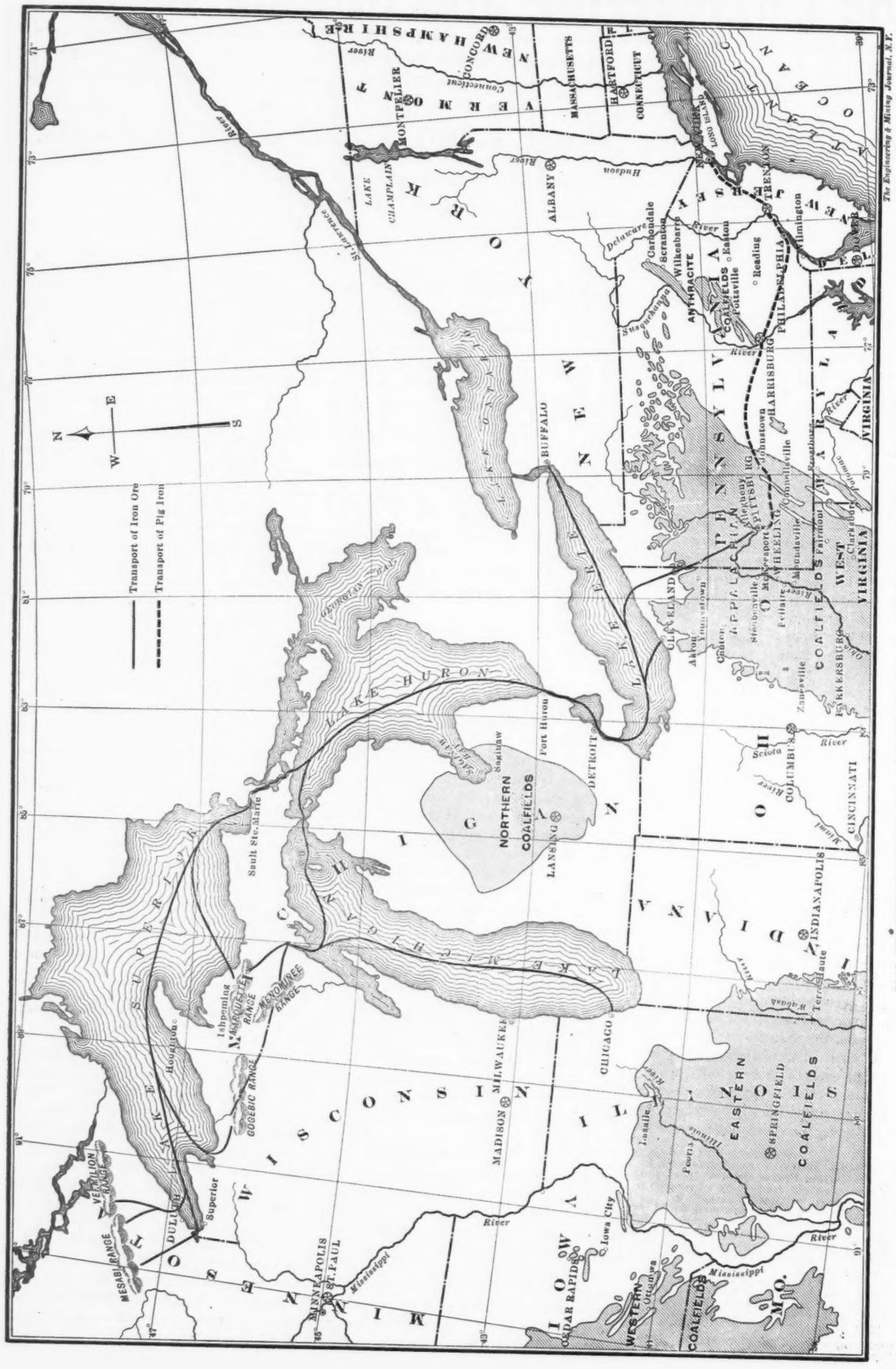
The United States Steel Corporation, however, issues very good reports. These and various isolated data published by the U. S. Geological Survey and such information as I could get from personal observation are the sources from which my conclusions are derived. The Steel Corporation is fully as much a manufacturing as a mining concern and even buys some of its pig iron from others. It does not stop with pig iron. It makes steel rails, sheets, wire, rods and even spelter and cement. It is the greatest of all industrial enterprises, employing more than 200,000 men. Naturally the reports of such a corporation must be condensed. As a matter of fact no operating data of any kind are given. The omission is in this case quite proper. The production, the earnings, the capital expenditures, the property holdings are all given. This information seems at first insufficient for any definite statement of costs, but it is all that can be had. On two recent trips to the Mesabi range, I saw a good deal of the mines, but I enjoyed no confidences. My inquiries were such as anyone could easily make. I make this explanation in order that no one may be under a misapprehension. The basis for the statements I am about to make is what I believe to be common sense.

Activities of the United States Steel Corporation

The operations of the Steel Corporation are undoubtedly representative of the Lake Superior iron business—far more so than those of any other concern. It mines and ships 55 per cent. of the whole product. It owns two of the three ore railroads in Minnesota and the shipments over its roads are 52 per cent. of the whole Lake Superior output. Just what proportion of the ore is transported on the lakes by the company's boats I do not know. When we come to pig iron we find that the company produces an amount equivalent to 55 per cent. of the probable content of Lake ores. It seems to have about 75 per cent. of the known ore reserves of the region.

NOTE—In this article I have assumed in regard to the United States Steel Corporation that the profits on ore hauled by others will be counterbalanced by profits earned by the corporation on ore hauled for others, so that the final result with regard to this transportation will be the same as if all the ore mined by this company were transported by the company. I have also assumed that the making of pig iron at Pittsburg is representative in cost, and that pig iron can be made at Pittsburg and sold at New York for as low a price as pig iron made at other points and shipped to New York. All tons are long tons of 2240 pounds.

*Mining engineer, 2 Rector street, New York City.



MAP SHOWING TRANSPORT OF LAKE SUPERIOR IRON TO SMELTING AND CONSUMING CENTERS

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We may conclude, therefore, that this company performs about 55 per cent. of the business all along the line and that its costs would be approximately the same if it did all the business.

One might argue that the costs of the Steel Corporation are radically different in some respects from those of the independents. For instance, an independent may have to pay 80c. a ton for freight that costs the Steel Corporation only 40c. It is for this very reason that the Steel Corporation is most representative. Its business is complete; that of the others, fragmentary. Just as the independents expect a profit on the ore that they own, so they must expect to pay a profit on the transportation that they do not own. It would be next to impossible to work out the real cost of pig iron if we tried to discover and weave together the obscure and disjointed costs and profits of a chain of discordant operators.

Capital Employed at Iron Mines

For the purpose of this article the capital employed is one of the most vital elements to consider. Remembering that we are to obtain our costs on pig iron and not on finished products, we must segregate the capital used in manufacturing from that used in mining and smelting. This can be done only approximately. Probably no one could make the division with absolute certainty, for it is necessary to remember that transportation, fuel and power facilities owned by the company are used for the joint purpose of manufacturing steel products and of producing pig iron. I am, therefore, compelled to make a division on my own judgment, and in order to enable the reader to estimate the legitimacy of this judgment, it is necessary to show the method of arriving at it.

The corporation owns in the Lake Superior region 72 iron mines of which 10 are on the Marquette range, 10 on the Menominee, 6 on the Gogebic, 6 on the Vermilion and 40 on the Mesabi range. Neglecting the purchase price of the properties, and considering only the actual money invested in the plants for machinery, development, etc., I make a rough guess that the total capital employed would be somewhat as follows:

Old ranges, each $2,500,000.....	$10,000,000
Mesabi range.....	25,000,000
Invested in extensive exploration and developments in the whole Lake Superior region.....	15,000,000
Total investment.....	$50,000,000

Capital Employed in Transportation

The Duluth & Iron Range railroad and the Duluth, Missabe & Northern railroad with a total of 363 miles of main line would be indispensable to the conduct of this business, even if it did not extend beyond the production of pig iron. We may calculate the value of this property at $50,000 to the mile, or in round numbers $18,000,000. The Elgin, Joilet & Eastern railroad and various small lines near the manufacturing plants with a total length of about 295 miles, may be estimated to belong half to the production of pig iron and half to manufacturing. I would charge, therefore, $7,000,000 in round numbers for these lines. The Bessemer & Lake Erie railroad with 205 miles of lines, I would charge entirely to the production of pig iron, and capitalize it at $10,000,000. This figures up a total of $35,000,000 for railroad tracks. In addition to this, we have the railroad equipment which I estimate at $52,500,000 out of which $40,000,000 would be necessary for the production of pig iron alone. We have then a total for railroads and their equipment of $75,000,000.

The marine equipment consists of 76 steamers and 29 barges. Many of these steamers are the largest and best upon the lakes, and some of them undoubtedly cost $700,000 or $800,000 each. I should say that the total equipment must be worth $40,000,000.

Capital Employed in Coal and Coke Properties

We have in the Connellsville and neighboring regions 62,253 acres of coal lands and 20,471 coke ovens. I believe it would be conservative to estimate the capital employed there at $30,000,000. In the Pocahontas district there is a lease on 65,497 acres on which are 2151 coke ovens. This property must have cost somewhere in the neighborhood of $10,000,000 for its development.

There are in addition 31,928 acres of steam-coal ground in Pennsylvania, West Virginia and Ohio. I would estimate the valuation of the plants employed on these properties to be at least $5,000,000. We have then a total of $45,000,000 for coal and coke plants. Of this I should say $35,000,000 would be necessary for the conduct of the pig-iron business of the corporation.

Capital in Blast Furnaces

The corporation owns, exclusive of its properties in the South, 100 blast furnaces, many of them the largest and best in the world. This property may be estimated at $125,000,000.

For the handling and shipping of iron ore, coke and coal, the corporation owns a large number of extensive docks, the total value of which I would guess at $20,000,000.

Capital in Inventory and Surplus

At the end of 1907, the inventory of stocks and materials used in the business was $136,000,000, and the surplus in the treasury was $122,000,000, making a total of $258,000,000 employed in the current conduct of the company's business. Of this I should say that one-half or approximately $130,000,000 would be necessary if the company's operations did not go beyond the manufacture of pig iron. As a justification of this assumption I may point out that the selling price of pig iron is about half that of steel rails and other heavy finished products which constitute the bulk of the company's sales.

Summary of Capital Used

We may summarize the capital as follows:

Iron-mine plants and developments	$50,000,000
Plants for transportation of iron ore.....	115,000,000
Coal, coke and quarry plants....	35,000,000
Docks and dock equipment.....	20,000,000
Blast furnaces.....	125,000,000
Working capital in inventory and surplus.....	130,000,000
Total	$475,000,000

It is to be noted that this estimate does not include the purchase price of lands or good will, but only such capital as would be required if the opportunity to conduct this business were a free gift. Capital so employed is worth in round numbers 5 per cent. interest, plus a sinking fund calculated to retire the principal in about 40 years. Such a fund is equal to about 1 per cent. additional. We must calculate the use of this capital then at 6 per cent.; and this is not profit. It is merely the actual value of the money employed, such a return as can be secured by an investor without burdening himself with the management of an enterprise. I, therefore, calculate as an operating cost of this business 6 per cent. of $475,000,000, or $28,500,000 per year. On an output of 10,000,000 tons of pig iron a year this is $2.85 per ton.

The Iron Mines

Let us return to the source of operations and consider what iron-ore resources the company owns. According to the reports of the Minnesota Tax Commission the various properties owned by the Oliver Iron Mining Company on the Mesabi range have in sight 920,000,000 tons. This, I believe, is an estimate only of those ores which are at present merchantable. The large quantities of lower-grade ores on the western portion of the Mesabi range, which depend upon concentration for their utilization, have not, I believe, been reported. The discoveries of this kind of ore are very extensive, and as experiments have gone to the point of demonstrating the practicability of concentrating them, these ores should be considered as a resource. What the total volume of such ores may be I can only guess, but I should say that it would not fall far short of 300,000,000 tons of concentrates, making a total of probable ore on the Mesabi range of 1,220,000,000 tons.

As to the ore resources on the old ranges I have no means of making an estimate. It is to be remembered that these mines extend to great depths and that the exploration of them in advance is not easy, but on the other hand many of them are exceedingly persistent and have already been worked for a great many years with no signs of exhaustion. As-

suming that these mines may be counted on to produce as much in the future as they have in the past, we get an estimate of 114,000,000 tons for the old ranges, that is, outside of the Mesabi range. Therefore, I would estimate in round numbers, the total ore resources of the Steel Corporation in Lake Superior at 1,300,000,000 tons.

It will be seen that I have estimated for the exploration and finding of these ores, outside of cost of mining plants in operation, $15,000,000. This seems to be an extremely moderate estimate of putting in sight such enormous reserves, but as far as I can judge by the inquiries that I have made the sum is somewhere near the mark. Explorations on the Mesabi range have been extraordinarily fruitful, and the cost for drilling seems to be not much over 1c. per ton developed.

Royalties

A very large proportion of the ores controlled by the Steel Corporation are not held in fee, but under leases on which the company pays a varying rate of royalty. This royalty has shown a constant tendency to increase. Many of the earlier leases provide for a royalty of only 25c. per ton and the leases were made for periods of 20 years or more. In some cases these leases are already near termination and new leases will have to be made at an advanced royalty. Some of the latest leases provide for royalties of 85c. per ton on standard ores with provision for still further increases.

It is probable that under present conditions the company pays an average of not over 20c. per ton, because a good deal of its ores are mined from its own lands, but it is manifestly unfair to the Steel Corporation not to allow for its own land a royalty equal to that which it must pay to other owners. On this basis it is probable that the actual royalty allowable on the ore should be about 40c. per ton.

On the theory that I have adopted for these articles, royalty is not wholly an operating cost, but is in a large part a profit paid to the owners of lands out of their exploitation. Nevertheless, it must be remembered that we have not charged off to capital any of the value of these lands. A certain sum must be allowed to the owners of fees for actual expenditures in holding and developing them, and in the present case it seems more logical to charge off a certain royalty for each ton of iron ore than it is to calculate the actual cost of developing and securing the lands and then to estimate interest and amortization on the total. This latter proposition is absolutely impossible. I believe, therefore, we shall not be far from the mark if we assume a uniform cost of 40c. per ton for royalty, whether the company pays this royalty to other people or pays it to itself.

Cost of Ore From Various Ranges

At present about two-thirds of all the ore from Lake Superior comes from the Mesabi range, but in the case of the Steel Corporation the proportion is over 74 per cent. It is probable that we would not be far wrong if we adopted a proportion of 70 per cent. from the Mesabi range and 30 per cent. from all the others. By making the above division we may make a reasonably close estimate of the cost of mining the Lake Superior ores in general.

On the old ranges the problem is essentially uniform. That is to say, there is no great difference in mining ore on the Menominee range, or on the Vermilion range. In all cases the work is done entirely underground, usually at depths between 500 and 1500 feet. Individual mines, of course, show great variations. In some cases the ore is extremely hard and in other cases extremely soft. Some mines have one large body of soft ore; others have a number of comparatively small bodies of hard ore, but these individual differences occur about equally on all of the ranges.

The cost may be estimated as a function of the output per man per day. In the case of the hard-ore mines, the output per man is as low as 2½ tons per man, while in some of the most favorable soft-ore mines the output exceeds 5 tons per man. Now, the average wages in the Lake Superior region for all men employed may be calculated at $2.60 per day. We further estimate that wages account for approximately 60 per cent. of the cost at the mines.

It is probable that the actual operating cost may be calculated at the rate of $4.25 per man employed. On this basis if a mine gets out 2½ tons per man, its operating cost will be $1.70 per ton; if it gets out 5 tons, its cost will be 85c. I believe the actual figures on the average would fall about half way between these extremes, and that the average output for the old range mines would be somewhere near 3¾ tons per man. This would give a cost of about $1.15 at the mines, exclusive of taxes.

Costs on the Mesabi Range

The cost of mining on the Mesabi range is determined almost absolutely by the depth of the surface covering. If the orebody is thin and the overlying surface deep, it is necessary to mine the ore by underground methods. In this case the cost of mining on the Mesabi will be approximately 90c. per ton, the average output per man being 4½ tons.

Open-pit mining varies greatly in cost. This work is now done universally by means of steam shovels and the cost varies according to the proportion of overburden to ore, the texture of the ore, the proportion of boulders and tongues of country rock in the orebody, and the amount of water to be pumped. These various factors cause abrupt variations in the cost.

We may calculate that the removal of stripping costs 32c. per yard. If one yard of stripping uncovers a yard of ore we will have one yard of ore containing 2½ tons mined at a cost of removing 2 yards of material, or 64c., making the mining cost 25.6c. per ton of ore. To this cost, however, must be added the interest on capital invested in preliminary stripping and other costs of preliminary development of the mine, the cost of pumping and of certain general expenses that do not occur on the ground, so that when equal amounts of stripping and of ore are removed, I calculate that the cost will be decidedly over 30c. per ton. This estimate does not include the cost of taxes which I shall presently discuss separately.

It is evident that the proportion of stripping to the ore does not vary directly according to the relative thickness of the surface and the underlying ore; it is a function of these factors combined with several other factors. The glacial material is usually much more uniform in thickness than the orebodies underneath. The latter are usually trough-shaped with many irregularities at the sides and bottom. Furthermore, pits must have sloping sides so that in cases where the depth of the ore is equal to that of the overburden there will still be a considerably larger volume of overburden removed from the pit than there will be of ore. These considerations induce a good deal of caution on the part of operators in the question of deciding upon open-cut mining where the overburden is deep.

Open Cut *vs.* Underground Mining

When the exact proportion of stripping to ore can be worked out, it is a simple question of arithmetic to figure where it will pay to adopt underground mining instead of open pits. As the cost of underground mining is about 90c. per ton, when open-pit operations are cheaper than that, theoretically the mining should be done by the latter method. But in practice we find that a good many practical considerations come in to interfere with carrying this method to its logical limits. Among these may be pointed out the necessity of investing a large amount of money in excavating the overburden before mining can be undertaken. In the case of companies that are financially weak this is a matter of considerable importance.

In many cases where open-pit mining would have been much cheaper, the ore has been mined underground because the mine could be opened more rapidly and a certain profit more quickly realized even though the operators knew that they were not securing the best costs. This argument does not apply to the Steel Corporation, of which the capital is abundant for undertaking operations in the most comprehensive way. As a matter of fact, it is in many cases resorting to open-pit

methods at mines where formerly, under other owners, the work was done underground.

Exigencies of Open-cut Operations

At first glance it would seem as if when a yard either of ore or of waste can be dug out by steam shovels for 32c. that the cost per ton would be approximately 13c., and that, therefore, it would be as cheap to mine almost 7 tons in an open pit as it is to mine 1 ton underground. In other words, 6 tons of stripping might be removed to secure 1 ton of ore. This would be the case were there no expense involved in mining except the actual digging.

As a matter of fact, there are other expenses that amount to considerable. One of these, the interest on the money thus locked up in stripping, I have already pointed out, but a still more important cause for hesitation in adopting open-pit mining to its full apparent limit is the considerable variation in the cost of steam-shovel work in different parts of the same mine. Where the ores are soft and uniform a steam shovel will undoubtedly dig a large amount of ore. In some mines the cost of digging ore for a period may go as low as 6 or 7c. per ton, but this may be followed by another period when the costs may be several times as high.

For instance, in 1906, at the Mountain Iron mine an output of 2,560,000 tons was obtained with a force of 500 men. The bulk of the work was done in eight months, say 200 days. At an average cost of $4.25 per man per day we get for this period a total cost of about $425,000. Supposing that for the remainder of the year one-half the force was occupied, we must increase the estimated cost by about $125,000, making a total for the year of $550,000. This equals 21c. per ton. In 1907, with an output of 1,973,000 tons 1200 men were employed. This indicates a cost of more than 65c. per ton.

Open-cut Mining Costs Variable

A part of the increase was due, no doubt, to an additional volume of the stripping undertaken, but a considerable part of the increase cannot thus be explained. In the orebody itself changes were encountered that not only diminished greatly the output per steam shovel, but also greatly increased the number of men employed per shovel. Up to 1906 the total number of men required in shops, train crews, track laborers, etc., per steam shovel never exceeded 75; since then it has been 100.

The reasons for this are: (1) Ore itself has become much harder, frequently breaking into great slabs and chunks that have to be sledged to make them suitable for reduction in the blast furnace. (2) Owing to the irregularity of the bottom of the deposit it is often impossible to provide adequate working faces for the steam shovels, so that along the bottom and sides the shovels frequently have to take shallow cuts, and sometimes the shovels suddenly run into worthless bars of rock. When the last occurs the machine must be moved to a new working place. (3) Boulder-like masses of worthless country rock occur in the ore which must be removed as waste. Consequently the excavation of ore by steam shovels, after the stripping is all done, may be much more expensive than is popularly believed.

Unwatering the Open Pits

The cost of pumping must be fully as high for open-pit as for underground mining and must be kept up just as steadily. The great pits form catchment basins, often many scores of acres in extent, and in the event of heavy rains, which are far from uncommon on the Mesabi range, the volume of water is often so great as to cause work to be suspended. Fortunately the ore is porous so that the pumping may all be done from a single shaft so located as to provide for the drainage of the entire orebody for all times. The volume of water ejected from a single orebody is frequently 5000 to 6000 gal. per minute. I estimate that when 5000 gal. per minute is pumped from a depth of 300 ft. and the output is 1,500,000 tons per year, the cost of pumping will be 7 or 8c. per ton. I suppose this is about a maximum cost for the Mesabi.

Now, returning to the question of where open-pit work should end and underground mining should begin, we find that the conditions are about as follows: The actual cost of digging ore in a pit where the ore is hard and sorting is necessary may run up as high as 40 or 50c. per ton. This cost will be reached when a steam shovel with a crew of 100 men at an average cost of $4.25 per day digs 20 cars, or between 800 and 1000 tons per day. The cost will not exceed 50c. per ton, because ore can be sorted and loaded as cheaply as that by hand without any steam shovel. Let us then put 50c. per ton as a maximum cost for digging.

The cost of administration, interest on development capital (largely stripping), and of pumping, is, of course, variable. Where 500,000 or more tons are mined in a year, all these expenses combined are not likely to exceed 15c. At the worst, then, we have 65c. per ton as the cost of mining in open pits, outside of stripping. Now, as underground mining will cost 90c. per ton, we have the difference between 90c. and 65c. to invest in stripping. This 25c. will remove 2 tons of overburden.

I therefore conclude that it will pay to remove 2 tons of overburden to 1 ton of ore, under the least favorable mining conditions. Under the most favorable conditions, where both the ore and the overburden are soft and uniform, the economical proportion may rise as high as 4 or even 5 to 1.

Average Cost of Mining on the Mesabi Range

This is a point on which no one can get exact information without access to the cost statements of at least 50 different properties, but in a general way I think we can get a rough estimate that will be sufficient for practical purposes. It will appear that the actual mining cost of the ore at the mines is not, after all, one of the greatest factors in the final cost of producing pig iron.

Returning to our output per man per day as a basis for calculating costs I find that during 1907 the mines of the Steel Corporation in the Hibbing district produced approximately 9,000,000 tons of ore. This ore came largely from great open-pit properties, but some of it came from underground mines. I am informed that the total number of men employed was about 4500 with 60 steam shovels. Supposing that the whole of this force was employed for eight months, and half of it for the remaining four months of the year, and assuming that 26 working days constitute a month, we get an equivalent of 260 days with 4500 men, each costing $4.25. This gives us a total of approximately $5,000,000, or in round numbers, 55c. per ton.

This estimate is open to doubt on several points, two of which are whether the amount of stripping that was done kept pace with or exceeded the amount of ore extracted, and whether the rough figures of labor employed are actually near the truth.

As to these facts I have no means of judging except the most general impressions, but I am satisfied that at the worst, my information is not far enough astray to make the cost hopelessly inaccurate. In a general proposition of this kind no one attempts to get down to niceties, and there is no occasion for it. When I state that the average ore mined in the Hibbing district costs 55c. per ton, I may be 15 or 20 per cent. astray this year, and next year I may be right.

The mines of Hibbing undoubtedly are the most favorable on the Mesabi range for cheap costs. They have the largest, softest and most uniform orebodies, and are worked on the largest scale. It does not seem improper, therefore, that if we estimate the cost at 55c. per ton at Hibbing, we should increase this to 60c. for the whole range. I therefore estimate that the average cost of mining on the Mesabi range for both underground and surface is about 60c. per ton, exclusive of taxes.

Taxes

The laws of Minnesota tax mining properties for what ore they have in sight. The tonnage developed is reported by the mining companies to the assessor who puts a valuation upon it according to the quality and accessibility of the ore. For purposes of taxation, discovered ores are placed in five or six different grades with a minimum valuation of 8c. per ton and

a maximum of 33c. Roughly, the ore developed seems to average about 15c. per ton in valuation. This valuation is taxed just as any other assessed property is taxed, the levy being somewhere in the neighborhood of 1½ per cent.

Since the Steel Corporation has in Minnesota on the Mesabi and Vermilion ranges about 930,000,000 tons on the assessors' lists, it would appear that the total valuation would be somewhere in the neighborhood of $140,000,000 and the taxation approximately $2,000,000. On this basis we find that the company must pay on its present output of approximately 18,000,000 tons, more than 10c. per ton on its actual shipments.

This taxation is a recent development. I do not believe that the company has as yet actually paid so much, but on a basis of present and future conditions it does not seem like an excessive estimate. The fairness of this mode of taxation it is not my present purpose to discuss, but it is very evident that a company with large ore reserves and a small output may be taxed much more than a company with a large output and small ore reserves. For instance, if the Steel Corporation had only five years' ore in sight instead of 50 years its taxes in its present tonnage would be only 1c. per ton instead of 10c. For this reason there are probably vast differences in the tax rates of various companies on the Mesabi range, and I suppose the Steel Corporation undoubtedly pays more taxes per ton of output than any of the others.

Explorations and Maps

It may be interesting to digress for a moment to consider the value of combination in the operation of these mines. Since its organization the Steel Corporation has pursued a most complete, scientific and satisfactory plan of exploring and mapping its ore reserves. It has employed expert geologists and engineers for this purpose. It has secured as much land as it could for exploration and has explored them to the point of determining, before any mining is done, the situation, volume, shape and economic characteristics of the orebodies on large tracts of land.

In other words, the process of drilling and test-pitting has been carried on until the depth of surface, the quality of the ore, its probable admixture with boulders and tongues of barren rock, and its thickness have all been determined. This information is expressed on maps which show the contours not only of the surface of the land, but also of the surface of the orebody underlying the glacial drift and the contours of the bottom of the orebody.

The information permits the planning of the mining work in such a way that there shall be no duplication of effort. The drainage of an orebody can be provided for with a single shaft so situated that it reaches the bottom of the deposit. The problem of mining is solved beforehand. In other words the propriety of mining in open pits or underground is predetermined. The location of pits, of dumping grounds, of railroad tracks and of all equipment is established once for all.

Drawbacks of Individual Management

Now, suppose these same orebodies were to be mined by different companies as was, or would have been, the case 20 years ago. The orebodies are sometimes a mile or even two miles in length and quite irregular in outline. The ordinary course of the longest axis of an orebody is northeast and southwest so that it would cross the subdivisions of the land diagonally. Such an orebody would inevitably occur on several sections, quarter sections or 40-acre tracts. The land ownership is scattered and irregular. It is seldom that any tract belonging to a single owner is larger than 160 acres and many tracts are only 40 acres in area. As a matter of fact most of the great orebodies on the Mesabi range belonged originally to five or six different companies.

In such a case it is evident that each company would have its individual management, its own problem of finance and its own requirements in the way of output. The mine located on one particular 40-acre tract might find the surface only 20 ft. deep, and it would plan an open pit. Since the neighboring ground was seldom thoroughly explored, the waste from this open pit might very likely be, and indeed was in many cases, dumped on ground afterward proved to be ore-bearing.

The next mine on the same orebody might find the surface to be locally 100 ft. deep, and if the operating company were poor and in a hurry for ore, it would undoubtedly open up its mine underground. The result of this would be that large sections of the surface would be caved down into the middle of the ore, thus preventing forever the successful stripping of that part of the orebody.

Economy of Large Ownership

But if this whole orebody were in the possession of the Steel Corporation, its explorations might show that the surface averaged about 50 ft. and that it might be economical to mine all the ore by an open pit. A single pump shaft would be sufficient. No waste would be dumped on neighboring ore-bearing ground. In short, a vast amount of duplicated expense would be avoided. This is where the value of such a combination comes in.

The Steel Corporation cannot get its work done any cheaper than anybody else. If it has to sink a shaft, for instance, it cannot do it any cheaper than any one of the half dozen mines that it might replace, but it could on the average sink one shaft for one-sixth the expense that it would cost other people to sink six shafts.

It is worth remarking in this connection that the Steel Corporation has been magnificently managed. It has not striven for minute and near-sighted economies. It has not tried to outdo its rivals in points of local rivalry, but it has kept in mind the broad outline of its operations and has tried to make use of its capital and opportunities in ways that every fair-minded man would recognize as legitimate. The company can do this only as long as it is well managed, but up to the present it is only fair to say that its activities have been well directed and that its economies are such as to be certainly of no disadvantage to the public at large, but on the contrary in many ways a great benefit.

Total Cost of All Lake Superior Ores

In order to keep the proportion of things in mind, even at the expense of some repetition, we may state that the cost of mining Lake Superior iron ores is for Mesabi ores, $0.60; old range ores, $1.15 a ton. Since the Steel Corporation mines about 7 tons of ore on the Mesabi range for over 3 tons mined on the old ranges, we may calculate that the actual cost of 10 tons would be $7.65 or 76½c. To this we must add taxes which on the Mesabi range are not far short of 10c. per ton. In order to make a round figure we may state that all Lake Superior ores would cost on the ground about 85c. per ton, including taxation. To this we may add 40c. per ton for royalty, making the total cost of Lake Superior iron ores at the mines, ready for shipment, $1.25 per ton.

Transportation of Ores

The ores which are mined on both shores of Lake Superior either in northern Wisconsin and Michigan or in Minnesota, must all be transported to the region lying south of the Great Lakes for smelting. The region of iron manufacture extends from the neighborhood of Chicago and Milwaukee at the northwest, eastward in a widening belt to Pittsburg and Buffalo and thence east to the neighborhood of New York City.

The factors which dictate the production of pig iron in this region are two, namely, the presence of coal and facilities for distribution. If we take Pittsburg as the most active and central point in iron manufacture to represent average conditions we find that the ores must be transported about 1000 miles in three sections: (1) There is the land haul from the mine to Lake Superior ports; (2) the lake haul from Lake Superior to Lake Erie; (3) the land haul from Lake Erie to Pittsburg.

The first division of the work is covered by five or six different roads—three in Minnesota and the remainder in Michigan and Wisconsin. The length of

haul is variable; from Ely, Minn., on the Vermilion range to Two Harbors, the distance is about 90 miles. Most of the ore from the Mesabi range has to be hauled from 70 to 100 miles so that I suppose an average distance for the north shore roads is perhaps 80 miles. Most of the ore on the Marquette range is less than 20 miles distant, while that on the Menominee range is about 50, and from the Gogebic range the distance is only about 30 or 40 miles to the harbor.

The published rates on ore from mines in Minnesota to the lakes is uniformly 80c. per ton; from the Gogebic range to Ashland, 40c.; from the Menominee range to Escanaba, 40c., and from the Marquette range to Marquette, 25c. In the case of any company other than the Steel Corporation it would be necessary to take these rates at their face value, but in this case there is reason to believe that the transportation is the most profitable part of the business.

The company does not own any railroads on the southern shore, but its two railroads on the northern shore, namely, the Duluth & Iron Range and the Duluth, Missabe & Northern, haul about 52 per cent. of the ore produced in the entire region. The corporation also owns a fleet of boats on the lakes, probably sufficient to transport an equal amount. It also owns the Pittsburg, Bessemer & Lake Erie railroad, which hauls most of the ore to Pittsburg. I think we shall not be far wrong if we assume that so far as costs go the results are the same as they would be if the company transported all its own ore from the Minnesota mines to the furnaces.

While the freight on ores from the south shore to Pittsburg is undoubtedly less than that from Minnesota, it is also true that the Steel Corporation must pay on ore transported from those ranges a profit to independent railroad companies which it does not pay in the case of Minnesota ores. Its profits on Minnesota ores which it hauls for other companies probably more than counterbalance the amount it pays in profits to others on the Michigan ores.

Automatic Handling of Ore

Iron ore is about the most easily handled material in the world. Its specific gravity is high, so that the ton does not occupy much bulk, and it is absolutely uninjured by the roughest treatment. As a matter of fact, it is loaded directly into dump cars either by the steam shovels or directly from the mine shafts. It is made up in trains of approximately 2000 tons of net freight and hauled over roads of very slight, or no, adverse gradients to the lake docks. There it is dumped by gravity right into the hold of the ship and transported in large cargoes on waters that are generally tranquil, and unloaded by machinery at the lower lake ports to be again delivered to the dump cars and carried as before to the furnaces.

I believe the operating cost of hauling such material by rail cannot exceed ¼c. per ton per mile. On this basis transportation from the mines to Duluth would cost about 20c., and from Lake Erie to Pittsburg about 40c. per ton, making a total for rail haul of 60c. The lake freight in all probability will cost, including unloading, an average of about 40c. Thus we have a total transportation cost of $1 per ton from the mines to Pittsburg. This, of course, is merely operating cost, and does not include the necessary return on the capital invested in the transportation properties, but this item I propose to consider as a lump to be added to the cost of pig iron so that I will not discuss it here.

We have, then, ore delivered at the furnaces at Pittsburg at a total cost of $2.25 per ton, distributed as follows: Mining 85c.; royalty, 40c.; transportation, $1.

Cost of Coke

Without going into details I think it would be fair to estimate the cost of Connellsville coke to the Steel Corporation at about $1.40 per ton. This is on a basis of 70c. per ton for mining the coal and using 1½ tons of coal per ton of coke at a coking cost of 35c. The freight rate from Connellsville to blast furnaces at Pittsburg is 75c. per ton, so that we may calculate coke delivered at the furnace at $2.15.

Cost of Producing Pig Iron

It is not probable that the average Lake Superior ore of today will yield much over 50 per cent. in pig iron before moisture is deducted. Since the tendency is toward a gradual reduction in the grade of the ore, it does not seem far out of the way to assume that two tons will be required for each ton of pig iron. We may now calculate when an average output of 10,000,000 tons of pig per year is made, the cost to be as follows: Use of capital, $2.85; 2 tons iron ore at $2.25, $4.50; 1.2 tons coke at $2.15, $2.58; limestone for flux, 50c.; labor and maintenance at furnaces, $1.40; general expense, 25c.; total cost at Pittsburg, $12.08; freight from Pittsburg to New York, $2.60; total cost at New York, $14.68.

An interesting commentary on the correctness of these figures is the testimony of Judge Gary in the tariff hearings before the Ways and Means Committee of the House of Representatives. Mr. Gary gives costs for the year 1906 for all the furnaces of the United States Steel Corporation. His figures are those not of actual cost, but of market prices for iron ores, coke and transportation.

The figures are as follows: Iron ore at $4.70 per ton; cost of ore used in a ton of pig iron, $8.62; coke at furnace, $3.93 per ton; coke used in making a ton of pig iron, $4.15; limestone per ton, $1.06; limestone in pig iron, 49c.; scrap, cinder and scale, 27c.; labor and maintenance at furnaces, $1.37; depreciation of furnaces, 40c.; total cost of making a ton of pig iron, $15.30.

From these figures Mr. Gary makes the following deductions for net profits: On ores in pig iron, $2.04; on coke in pig iron, 60c.; on transportation, $1.07; total deductions, $3.71. Subtracting this amount we have by Judge Gary's estimate $11.59 per ton as the cost of pig iron at the furnaces.

There is, however, some doubt as to the exact application of the figures presented by Mr. Gary. Anyone who is familiar with testimony taken at a hearing will understand why this is so. I have gone over the evidence and put together the figures in another way. I do not know which is the most accurate.

MR. GARY'S FIGURES IN DETAIL.

Actual cost of iron mining at all mines	$0.73
Actual cost of coke at ovens	1.21
Actual cost of iron ore at furnace	2.83
Actual cost of coke at furnace	3.39
Pig Iron.	
Iron ore per ton pig	5.50
Coke per ton pig	4.07
Limestone	0.49
Cinder and scale	0.27
Operating blast furnaces	1.38
	$11.71
Depreciation of blast furnace	0.40
	$12.11

It will be noted that the sum total of Mr. Gary's figures are almost identical with those of my independent estimates. It is to be pointed out, however, that Mr. Gary's figures are for all the furnaces of the company, while mine are for Pittsburg alone. This fact will make a divergence in the details unavoidable. Furthermore, my figures are for general conditions as they are at present, while Mr. Gary's are exact statements for a single year. After giving the matter considerable thought I have decided to leave my estimates as originally made. They will at least serve to show something of the logic of calculating costs.

One mine in Australia is being operated for rutile. It is owned and worked by Francis J. Spence, and is 45 miles northeast of Adelaide in South Australia. The present production is small, but could be increased at any time, if a demand should arise for the mineral, as for instance, from the use of titanium in making steel. At present the demand is not important. Rutile is valuable chiefly for its high titanium content, and its principal uses at present are in the coloring of porcelain and of artifical teeth and in the manufacture of some forms of arc lamps.

Hitherto the deepest borehole in the world has been that near Rybnik, Upper Silesia, 2003 m. This depth has now been exceeded by a hole at Czuchow, in the same district, which has already reached 2156 m., and is to be continued to 2250 m., if possible. The hole was commenced in December, 1906, with a diameter of 16 inches.

The Mount Morgan Mine, Central Queensland

An Enormous Body of Ore Which Supports 12,000 People and Has Produced $70,000,000 of Which $37,000,000 Were Paid in Dividends

BY J. BOWIE WILSON*

Lying within the coastal edge of the hills that traverse the eastern side of Australia parallel to the coast the Mount Morgan mine, Central Queensland, has an altitude of about 800 ft. above sea level. The climate, although semi-tropical, is healthy, the extreme heat of the summer days being tempered by almost invariably cool nights. The atmosphere is dry and no tropical fevers are prevalent.

The climate is one in which white men can easily work and without apparent deterioration. A large percentage of the men now working at Mount Morgan have either been there for 20 years, or were born in the district; and it would be hard to find a body of men in better physical condition which I think tends to show that even the tropical portions of Australia, when once clear of the low-lying strip of coast country, are suitable for a white population. From the very beginning of the Mount Morgan company the whole of labor employed has been European, or the descendants of European settlers.

MILLING SYSTEM, SHOWING FUNNEL-SHAPED PITS AT SURFACE

Mount Morgan, the Town

The town of Mount Morgan, called after the mine, has been built just outside the mine works upon the banks of the Dee river, which in common with so many so-called Australian rivers contains running water only during the rainy season. The town is connected with the Queensland government railways by a short branch line 12 miles long, also built by the government, which junctions with the main central line at Kabra.

Mount Morgan has a population of 12,500, and is an uptodate mining town, having an excellent hospital, school of arts, a technical college, a local telephone exchange which is also connected with Rochhampton, and is lighted with gas supplied by a private company. The inhabitants depend wholly upon the Mount Morgan company for their support, as there is only the one producing mine in the district and the surrounding country is worthless for either agricultural or pastoral pursuits.

The fact that up to the present no payable mines have been located outside the Mount Morgan company's holdings is

*Mining engineer, Sydney, N. S. W.

often commented upon, but when it is remembered that this company secured 750 acres in the early days and still retains them, having sold only the surface rights of a few blocks near the town, it is not surprising that they hold all the valuable portions of the ore deposit.

Water Supply

The town depends for its water supply wholly upon what each individual stores in tanks from the catchment of his dwelling; as the rains are erratic and the district must be considered a dry one, the supply of good drinking water frequently runs short. The company has built seven dams across the Dee river at different sites to supply the works with water, of which the four largest are still in use. When full these have a capacity of 370,000,000 gal., but even with this supply the works have several times been threatened with stoppage through a shortage of water. During the big drought of 1902 for seven months all the water required by the company was carried from Stanwell about 17 miles by rail. The storage capacity has since been increased, but the treatment capacity of the works has also increased, so that even today the company is not in too good a position to withstand a prolonged drought.

The Ore Deposit

The Mount Morgan deposit was discovered in 1882, quite by chance, by the Messrs. Morgan, when they were returning to Rockhampton after an unsuccessful attempt to locate a reported silver lode on Nine Mile creek, about 19 miles from Mount Morgan, and which, by the way, has never yet been located. Heavy rains falling, the creeks became flooded, and the prospectors were forced to camp in a deserted shepherd's hut on the Dee river. While waiting for the creek to fall, one of the Morgans, taking a dish and pick, went prospecting, and in passing over the hill now called Mount Morgan noticed some peculiar iron-ore boulders, pieces of which he broke off, and carrying them down to the water, crushed them and panned off. He obtained such a rich prospect that he could not believe that it was gold in the pan.

The Morgans took samples back, far away, to Rockhampton and the returns were all rich. After another trip to the locality they pegged out claims and formed a local syndicate in Rockhampton to develop their discovery. The mine was practically self-supporting from the start, only a few thousand pounds being put into the property. The syndicate worked the property until 1886. No records of their profits during this period are available, but in that year they formed themselves into a limited liability company of 1,000,000 shares of £1 each issued as paid up to 17s. 6d. per share. The flotation of the company was purely the transferring of the existing syndicate into a company as all the shares were allotted to the members of the syndicate in proportion to their holdings. The company remained in this form until 1902 when the directors made a call of 2s. 6d. per share and at the same time declared an extra dividend of 2s. 6d., thus making the shares fully paid up and taking away all liability from shareholders.

The origin of the deposit is still open to discussion but it must clearly be classified as belonging to the class of impregnations or metasomatic deposits. The

CRIBBING USED IN THE COPPER-GOLD OREBODY

country rocks around mount Morgan are of sedimentary origin belonging to the Gympic series of the Permo-Carboniferous age, but they have been greatly altered by dolerite dikes and intrusive masses of hornblendic granite and now appear as quartzites and quartz felsites.

Open-cut Mining

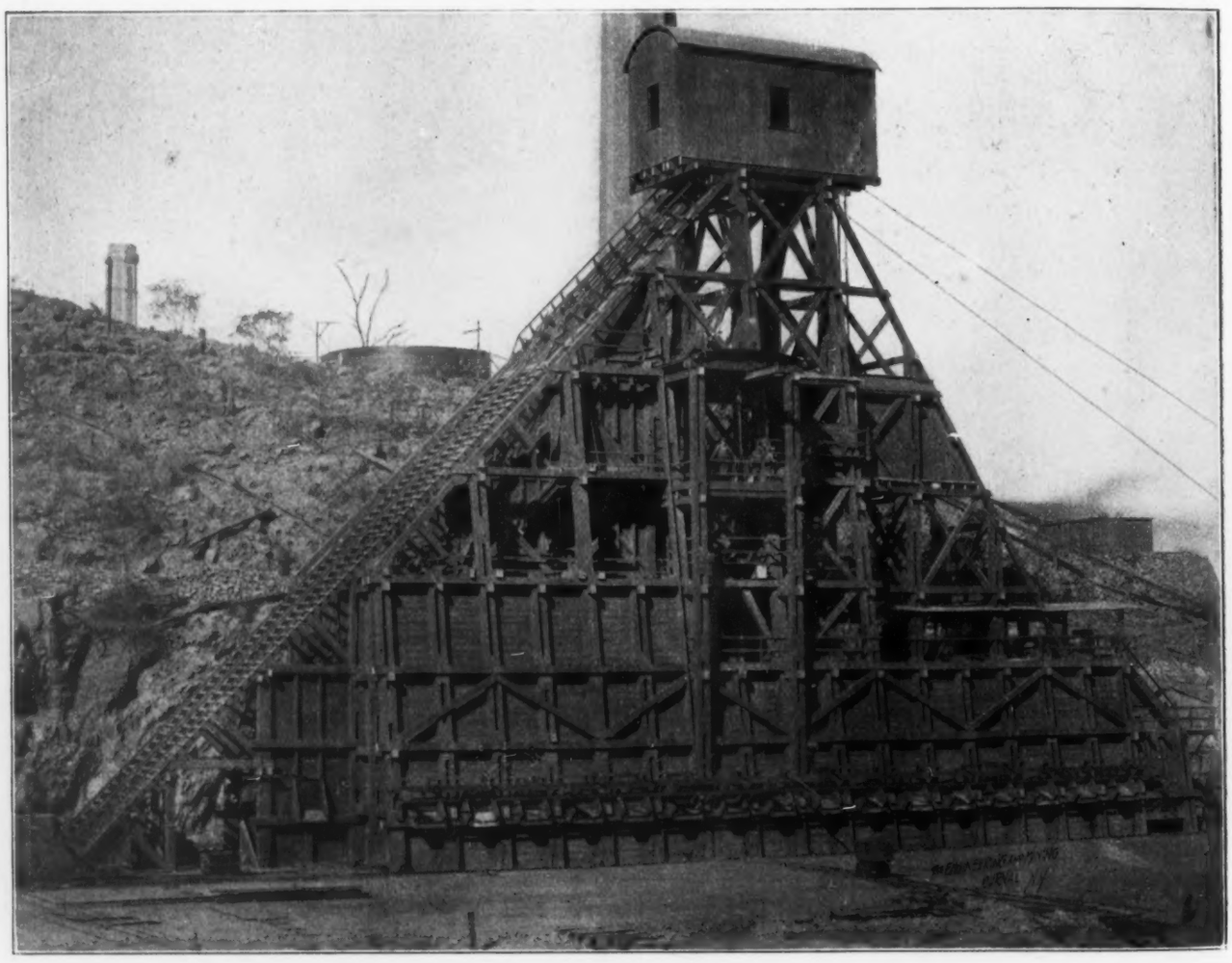
The open cut was started in the early days of the mine by benching the orebody on the top of the hill and this has developed into the present huge quarry. At first it was not realized that it would pay to remove the whole top of the hill and a lot of money was wasted by mining by the square-set system ore that should have been quarried in an open cut. For instance, on the Grantree level or floor No. 21 (315-ft. level) more than 2000 sets were mined, each set being 6x5x7 ft. 9 in. high, and now the open cut is down to the 360-ft. level.

The open cut was originally worked like an ordinary quarry in benches, the ore being shot down from the faces upon floors, shoveled into trucks and tipped into passes leading to drives upon the level of the works bins. When the west works were built upon the side of the hill, to replace the old lower works and to treat the oxidized ore, a main tunnel was driven right through the hill upon the level of the works hoppers (285-ft. level) and all the oxidized ore was passed down to this level and drawn to the hoppers, at first by two small steam locomotives and later by electric motors.

Milling System

This bench mining has now been abandoned as much as possible in favor of the milling systems in which a rise is put up, to act as an ore pass, from a drive to the surface and then the material worked out around the pass until it has the appearance of an inverted cone with the top of the pass at the apex. The milling system would be used exclusively, but for the fact that in parts of the present open cut old filled-in workings occur, and it is not always convenient to get the necessary drives and rises in the proper positions. With bench mining it is also easier to hand-pick the ore, and in places this is advisable. Where the dikes or bands of poor ore are of any size it is possible, in milling, by carefully placing the shots to shoot down ore and waste separately when the waste can go straight to the tip or to the waste passes for filling in the underground stopes.

In mining out the old filled-in stopes, the timber is recovered and, being all hardwood, iron bark and spotted gum, most of it is sound enough to be used again in the mine. As the tenons of the legs are often broken, these are either cut into caps and struts or used for double banking a weak set, or for temporary pig-sties in the copper chambers for supporting a bad piece of roof.



HEADFRAME AT MAIN SHAFT

Down to the 315-ft. level practically the whole of the ore removed from the open cut was oxidized, but at about this level the ore changed to sulphide and now all the eastern side of the open cut is in unoxidized ore. The change from completely oxidized to sulphide ore is remarkably sharp taking in places only a few feet to change from the one to the other.

Economy of Open-cut Mining

The economical limit of an open cut is

reached, or course, when the cost of removing waste to allow a safe batter to the sides of the quarry, per ton of ore exposed equals the difference between open-cut and underground mining. It was estimated at Mount Morgan that this point will be reached when 450 ft. below the original summit of the hill.

To handle economically the overburden that had to be removed to allow this depth to be reached, in 1903 a 65-ton Bucyrus steam shovel was imported and erected. I believe that this was the first shovel of any size to work in Australia. It has done excellent work at Mount Morgan, its only disadvantage being that the type in use can work only on a siding as it will not clear enough room in a heading to allow a train to run beside it.

To do this work a shovel of English design, a Witaker, was imported. As this style of shovel revolves completely round, it can discharge into trucks at its rear and so can work in a heading and prepare the way for the Bucyrus shovel, but for quickness of work and cheapness it is not to be compared with the Bucyrus. Three 10-ton locomotives, of English make, running upon a 3½-ft. track, took the waste away from the steam shovels.

Although the sides are only being removed to allow a safe batter to the edge of the ore on the 450-ft. level, it will be quite possible to open-cut the center of the deposit below this level.

There is one great disadvantage in an open cut. In spite of drains, wherever possible, it acts as a catchment area for the mine and when the rainy season is on it pours a large quantity of water into the mine. This would be more serious in a locality blessed with more rain than central Queensland.

Square-set Mining

The square-set method was adopted for the gold ore when underground mining was first started and it is still in use in the older part of the mine to the east of the andesite dike. This method of timbering is safe and holds ground well, when care is taken to keep the sets filled close up to the workings, but it is undeniably expensive. Still, even in the face of the expense, I fail to see how it would have been possible to adopt a cheaper system of mining this part of the deposit, when the payable ore occurs in the midst of masses of unpayable rock and one can never be quite certain where a stope will end when starting it. The square-set system can be expanded and contracted at will without interfering with the safety of the stope and by slabbing up the outside sets before filling in, it is possible to leave the stope so that it can be worked round again if a new discovery shows this to be profitable or a reduction in treatment costs converts unpayable ore into payable.

The square-set system readily adapts itself to the keeping of accurate assay plans, as the exact position of each set can be obtained without excessive surveying. As all underground mining is done by rock drills, the sample of a set is taken by mixing some of the borings from each hole put in to mine the set. In an orebody like the Mount Morgan deposit where the gold cannot be seen and the gold is very fine and generally evenly distributed this method of obtaining samples is fairly accurate. It has frequently been checked and has always been found to give close results.

Of course in practice before mucking a set that has given a low assay return, the value of the surrounding sets is taken into consideration, and if it happens to be in good company, it is considered safe to send the material to the works hoppers if there is no time to check the sample. A set of ground equals about 20 tons on the average, and a separate assay is made for each set. Assay plans were only started in 1902, and they have been found invaluable, and the even grade of the ore sent to the works can be largely attributed to their use.

OPEN CUT, FREEHOLD LEVEL, SHOWING TIMBER IN OLD STOPES

Chamber and Filling

When the copper-gold orebody was prospected and blocked out by bore holes it was found that it would pay to mine completely a large area of the deposit. To avoid the costly timbering of the square sets it was decided to mine this body of ore in chambers. As the south dike, 20 ft. thick and practically vertical, runs through this body of payable ore and parallel with its greatest length, it was decided to run the chambers parallel with the dike, and to make use of it as a wall between the first two chambers.

These chambers are 60 ft. wide, and the length depends on the extent of the payable ore. On the 750-ft. level the chambers have an average length of 400 ft. The cross-drives which pass through the dike. By side stoping from these drives the sill cuts of the chambers were mined. While this work was proceeding winzes were sunk, about 100 ft. apart, from drives on the level above to act as passes for the waste required for filling in the stopes.

If the level below is already opened up it is best also to sink winzes to it, as it is easier to do the work at this stage than afterward from the drive kept open through the filling. These winzes are also convenient for ore passes when removing the ore broken in the second cut of the chambers and before the filling is run in.

Stoping and Filling

After the sill cut has been mined, only an occasional pillar being left in to help support the roof, the second cut is mined from the chambers by overhand stoping to raise the roof to about 20 ft. This was done by first cutting across the chambers, at the end nearest the shaft and then advancing in a breast up the chamber. The machines were rigged upon the heap of broken ore, the top of which was kept about 7 ft. from the roof.

Before firing the holes bored in the breast, sufficient ore was removed from the face of the heap to make room for the rock to be broken by the firing, and to leave room to rig up again after the roof had been worked down. To do this either a trucking way has to be kept open by timber through the heap of broken ore or the chambers have to be worked so that the shaft can be reached through the cross-drives, connecting the two chambers. This is the simplest way, but to do it one chamber has to be mined in advance of its neighbor. When laying out the work this necessity of removing ore from the face of the heap must be kept well in mind.

After the second cut has advanced sufficiently to allow some of the broken ore to be removed, still leaving sufficient upon which to rig the machines at the face, the broken ore is shoveled away. When a section of the chamber has been cleared poles are laid across the floor and slabbed over; a drive is formed of two parallel pigsties roofed over with poles covered with slabs and filling poured into the chambers and leveled off to within 5 ft. of the roof, when the third cut can be started. Pigsty chutes are built up through the filling at short intervals for passing the ore down to the drive. The filling is allowed to lie against the dike, but a pigsty is built along the outside walls of the chambers to keep the filling from the ore left there and also to keep the filling in place when the next chambers are to be mined. The flooring is laid so that the stope coming up under the chambers may be worked right up.

STEAM SHOVEL NO. 1 ON FREEHOLD LEVEL

width of payable ore greatly exceeds the combined width of these two initial chambers, the outside walls of both being composed of ore of much the same grade as that mined; additional chambers parallel to these are opened up when required.

The width of 60 ft. was decided upon because it was not thought prudent to have a greater width of practically unsupported roof open at one time especially as the walls of the dividing dike, being partially decomposed, cannot be greatly relied upon, and if the dike is eliminated there is at present 140 ft. between the outside walls.

To start the chambers, drives were first driven down the center of each chamber and connected at the middle and ends by

Other Details

In filling in the chambers the waste is conveyed in side-dumping cars by an electric motor to the required pass and poured

into the chamber until the natural slope of the heap reaches the roof of the chamber and blocks the pass. Shovelers are then put on, and starting on the sides of the heap at the desired level, throw back the filling until they have filled in as much of the chamber as can be reached in this way. Just before this point is reached they stop putting waste into the top of the pass to allow the shovelers to empty it and to level off the heap under it. A rough chute is then put in the pass by running holes up the four corners and slabbing them in, when the remainder of the required filling is drawn off in cars. The filling passes were spaced 100 ft. apart, but they could have been closer with advantage.

The rock at Mount Morgan is, on the whole, excellent standing ground, or this method could not, of course, be used, but trouble occurs in the neighborhood of the small dikes, when temporary pigsties of timber have to be erected to protect the men. These can generally be completely recovered as the stope is filled, fresh ones being built up from the filling to pick up the roof. This work often requires great skill and ingenuity on the part of the underground boss.

Although to miners accustomed to small, well timbered stopes, these chambers look unsafe, up to the present there have been no accidents at Mount Morgan that can in any way be attributed to this method of mining.

Shafts

Until the beginning of 1907 all the shafts in use were small and vertical with three compartments, 10½x6 ft. in the clear. They were sunk in the orebody and none of them hauled ore directly to the surface. Their engines were underground, driven by compressed air, and they hoisted ore to tunnels upon the level of the works ore bins. All the ore was handled in cars containing on an average 18 cwt., in single-deck cages with the usual safety appliances.

In 1905 when the copper-gold orebody was being developed and the smelting works were erected, a new shaft was sunk to handle the increased output of the mine and also to replace the old shafts, and to allow the surrounding ore to be mined. This shaft, called the incline shaft, was placed upon the southern side of the hill and with its mouth outside the deposit and upon the 315-ft. contour which is the level of the mundic works hoppers, and about 70 ft. above the smelter hoppers.

It is a three-compartment shaft 17x8 ft. over all, and is sunk on an angle of 45 deg. The two hoisting compartments are each 5 ft. 6 in. wide, and in the other compartment a stairway is built. It is connected with the mine workings on the 450-, 574-, 650-, 750- and 850-ft. levels, and was in 1908 sunk to the 950-ft. level. The ore is hauled in skips running upon rails and capable of holding from 5 to 6 tons; they are filled by chutes from pockets sunk from the various levels to the roof of the shaft. The main levels have each two pockets, so that either gold ore or copper-gold ore can be drawn as required.

The skips are self-dumping and discharge into a small hopper at the top of the headgear. This hopper is kept small so that when the class of ore being hauled is changed it can be emptied in a few minutes. The ore passes next through a Gates breaker which discharges upon a belt conveyer, which runs the length of the headgear. If the ore being broken is gold ore for the mundic works the conveyer, by means of a tripper, distributes it along the hoppers which form the base of the headgear and from which it is drawn in side-dumping cars by an electric locomotive to the works hoppers. If the ore is for the copper smelters the belt delivers into one of four ore pockets which are sunk to a tunnel upon the level of the smelter bins, the ore being drawn in large hopper cars by a steam locomotive to the bins.

Incline Shaft

The incline shaft is intended for handling ore only; all men and supplies enter the mine on the 450-ft. level and are at present lowered down one of the old shafts. To free this old shaft and more economically handle the men and supplies the Linda shaft is now being sunk. This shaft is really an inclined tramway, as it is going down on a grade of 1 in 3. It starts at the mouth of the Linda tunnel (450-ft. level), and will connect with all the main working levels.

Although the cost of this shaft will exceed by about £2000 the amount for which a vertical shaft could have been sunk, clear of the deposit, it is expected that this amount will be saved in a couple of years by the decreased cost of handling the men and materials. The vertical shaft could not have been sunk from the surface; so that all steel and material would have had to be handled as at present, which is as follows: Loaded upon trucks and trucked to the shaft plat, unloaded and loaded upon the cage, lowered to the required level and unloaded from the cage on trucks again. All this handling is expensive and also hangs up the shaft a lot during the loading and unloading of the cages. With the new shaft as each level is connected with the shaft by a turnout, on a vertical curve, the material once loaded on the cars can be lowered down the shaft and shunted to the level and left there ready to be taken to the working face. Although a much greater distance has to be sunk the cost per foot is about one-third of that of sinking a vertical shaft and no expensive headgear is necessary.

OPEN CUTS AND DUMPS, LOOKING SOUTH

Breaking Ground

The rock drills in use are the Ingersoll-Rand-Sergeant auxiliary valve. All machine steel is sharpened in Ajax drill sharpeners, two machines being in constant use on three shifts with a third machine kept as a stand-by. Blasting powder is used in the jumper holes in the open cut, the holes being bulled with dynamite. Underground, Nobel's gelignite and No. 1 blasting gelatin are exclusively used, the latter in the harder ground, but sometimes only for bringing out the cut, the side holes being then fired with gelignite.

Labor Conditions

The open cut is only worked on a day shift of eight hours. Work starts at 7:30 a.m., and ends at 5 p.m., with two spells of ¼ hours each at 10 a.m. and 3 p.m., and ½ hour at noon for dinner. On Saturdays the men knock off at noon, but it counts as a full day, the extra ½ hour worked bringing it up to seven hours, so the men work only 47 hours a week, but are paid for 48 hours. All work in the open cut is done on wages.

In the gold stopes the work is cut at so much per square set erected, and in the copper chambers at so much per ton of ore delivered to the chutes. Contracts are let for a period of eight weeks, all the contracts being let upon the one day, so that all the miners have an opportunity of tendering for each job. All tenders have to be delivered at the mine office in a closed envelop, and if on opening the tenders the lowest is not considered satisfactory, the work is either done on wages or left until the next contracts are let.

Progress payments are made fortnightly, on the same days as the wage men receive pay, but 10 per cent. is withheld until the satisfactory completion of the job. Contractors supply all explosives, candles, machine oil and fuse, but the company supplies air, machines, tools (which later must be returned in good condition), and timber; the contractors must erect the timber to the satisfaction of the mine manager. The contracts are let to small parties of men (generally 12) and half of them have to be in the contract and sign the specifications.

Although the contracts average more money than can be earned on wages, still the work is done cheaper per foot and per ton than can be done by the company itself on wages work. The contract system has never given any trouble at Mount Morgan.

The Hamilton Iron and Steel Company, at Hamilton, Ont., is about to install the Gayley dry-air blast at its furnace. The contract for the refrigerating plant has been awarded to the De La Vergne Machine Company, New York. Frank C. Roberts & Co., Philadelphia, are doing the engineering work.

Aluminum Direct from Bauxite

The practice in aluminum reduction is first to purify the bauxite by one smelting operation, and then to treat the refined alumina in the reduction furnace. This is necessary from the fact that the usual impurities in bauxite are more easily reducible than the alumina, and having once found their way into the aluminum, are difficult to separate commercially. The extra expense of this procedure, arising from the larger plant required and the loss of heat, has led a German inventor (German patent No. 204,004) to propose a process whereby the purification of the alumina and the reduction of the aluminum go on more nearly together, with the liberation of a valuable by-product.

The crude bauxite is mixed with carbon and a boron compound, and treated in the electric furnace. The iron and silica go into combination with the boron, forming an exceedingly hard material which has a commercial value as an abrasive, while the pure alumina passes to another part of the same furnace, or to another furnace, if desired, for reduction into aluminum, in the usual way.

Copper in the Transvaal

Special Correspondence

The report issued by the Messina Copper Mining Company shows that, although the Transvaal's only copper producer is of small concern in comparison with the mines of other countries, it is at last assuming a permanent place among the colony's few base-metal properties of profit-making capacity. Ore reserves are now estimated at 27,782 tons containing 16.3 per cent. copper. The plant erected consists of rolls, jigs and Wilfley tables capable of treating 50 tons of ore per day. Situated in the extreme northern Transvaal, the Messina district suffers severely for lack of cheap and rapid transport. By improved roads, the $1.44 cost of mule and donkey transport has been reduced to 96c. per lb. Since the war, the government has adopted a vigorous policy of branch-line construction, but there are two regions of importance from the mining standpoint, which still urgently need practical assistance in this respect. First, the Lydenburg goldfields, which record an output worth £450,000 per annum, and second, the Zoutpansberg district, to the north of the railroad at Pietersburg. That a line will shortly be built as far as the southern part of the Lydenburg field is practically assured and it is now further reported that negotiations with the government have been satisfactorily concluded with regard to the service of the Zoutpansberg region.

Ontario Mineral Production

The Mines Department of Ontario has made a preliminary report of the production of that Province in 1908. The metallic production is reported as follows:

Gold	ounces	3,465	$60,337
Silver	"	19,424,781	9,125,903
Cobalt	tons	1,224	110,166
Nickel	"	10,175	1,866,059
Copper	"	7,561	1,071,140
Iron ore	"	199,395	537,379
Pig iron	"	271,656	4,390,839
Total value			$17,161,823

From the total value must be deducted value of 170,215 tons Ontario iron ore converted into pig iron in the Province; this was $456,176, making the net value of the metallic production $16,705,647. The valuation of all the metals was lower than in the previous year.

The silver mines of Cobalt yielded 9,000,000 oz. more than in 1907, but owing to the fall in the price of silver the value was not correspondingly greater. Shipments of ore from the silver mines amounted to 24,485 tons. A little less than a third of the total tonnage was treated in Canadian reduction works, most of the remainder going to the United States, and a small amount to Europe. The ore treated at home was largely high-grade, the lower qualities being sent mainly to smelters in the United States.

The value of the non-metallic products is reported as follows:

Arsenic, refined	tons	702	$40,373
Arsenic, crude	"	2,970	
Calcium carbide	"	2,364	147,150
Corundum	"	141	14,977
Feldspar	"	7,875	20,300
Graphite, refined	"	10	1,600
Gypsum	"	10,389	20,778
Iron pyrites	"	20,970	69,980
Mica	"	368	73,586
Natural gas	"	.....	969,160
Peat fuel	"	200	900
Phosphate of lime	"	881	7,048
Petroleum	Imp. gal.	18,479,547	703,773
Quartz	"	44,741	52,830
Salt	"	79,112	488,330
Talc	"	1,016	3,048
Total value			$2,613,833

There was a considerable falling off in petroleum.

The output of building materials and clay products was as follows:

		Quantity.	Value.
Brick, tile, etc		.....	$2,600,000
Portland cement	Bbl.	2,022,877	2,417,769
Lime	Bus.	1,850,000	357,050
Pottery		.....	50,310
Building stone		.....	475,000
Total value			$5,900,129

This brings the total values up to $25,219,609. Values are computed at the selling prices at the mines or works, and in the form in which the substances are produced.

On the Rand, South Africa, the Randfontein and Langlaagte mines use one tube mill to regrind the pulp from 46 stamps; the Eckstein mines, one tube mill for 56 stamps, and the Gold Fields mines one for 60 stamps.

Methods of Mining Coal in New Zealand

Detailed Description of the Westport-Stockton Colliery, where the Equipment and Prevailing Ideas Are along the Latest American Lines

BY SIDNEY FRY*

The latest addition to the coal mines of New Zealand is that of the Stockton colliery, which is situated in the heart of the bituminous coal areas of the South island.

The company which is operating this mine was floated by Mr. Munro, an enterprising citizen of Westport, and was incorporated in August, 1905, for the object of opening out and operating a coal lease of 1500 acres in area, which was afterward increased to 2000 acres. The chairman of the company is William Reece, a well known man of Canterbury, N. Z., and its engineer is G. H. Broome, who was at the time of the formation of this company, in charge of a colliery at the Crow's Nest Pass in Canada. This gentleman designed and equipped the mine on American lines, fitting it out with an electrical equipment which probably is not equalled south of the equator.

*Mining engineer, Westport, New Zealand.

Location of the Mine

The mine is situated about 20 miles northeast from the port of Westport; it is at an altitude of 2000 ft. above sea level, and back about 3 miles from the coast. The coal is delivered from the company's tram-lines and inclines into their bins, which are on the flat of the foot of the hills fronting the sea, and close beside the State railroad track. All the valleys in the neighborhood are covered with an abundant growth of red pine, black birch (*fagus fusca*, really a beech), and other useful New Zealand mining timbers.

Geology and Quality of the Coal

The geology of the coalfield is simple; the coal measures, which are of cretaceous age, repose unconformably upon the upturned edges of highly inclined strata of granwacke and argillite of Devonian and Carboniferous age which are sometimes intruded by acid eruptives; and upon granite and gneiss of probably greater age than Devonian.

The lowest member of the coal-bearing series is usually a bed about 20 ft. thick of conglomerate; this sometimes merges into a series of thin beds of shale, sandstone, conglomerate and arkose. Overlying this is the coal, the seam, varying from 10 to 20 ft. in thickness. Then follows a bed of silicious sandstone or grit 5 to 50 ft. thick. Then 20 ft. of brownish gray micaceous sandstones, covered by 1000 ft. of sandstones and marly shales.

The foregoing is the series as they appear in dip section dipping under the sea at the foot of the hills, but there has been extensive denudation, and on the hills there is only about 100 to 200 ft. of strata overlying the coal.

The operators claim to have discovered two distinct seams of coal on the property, but they will find that this is purely

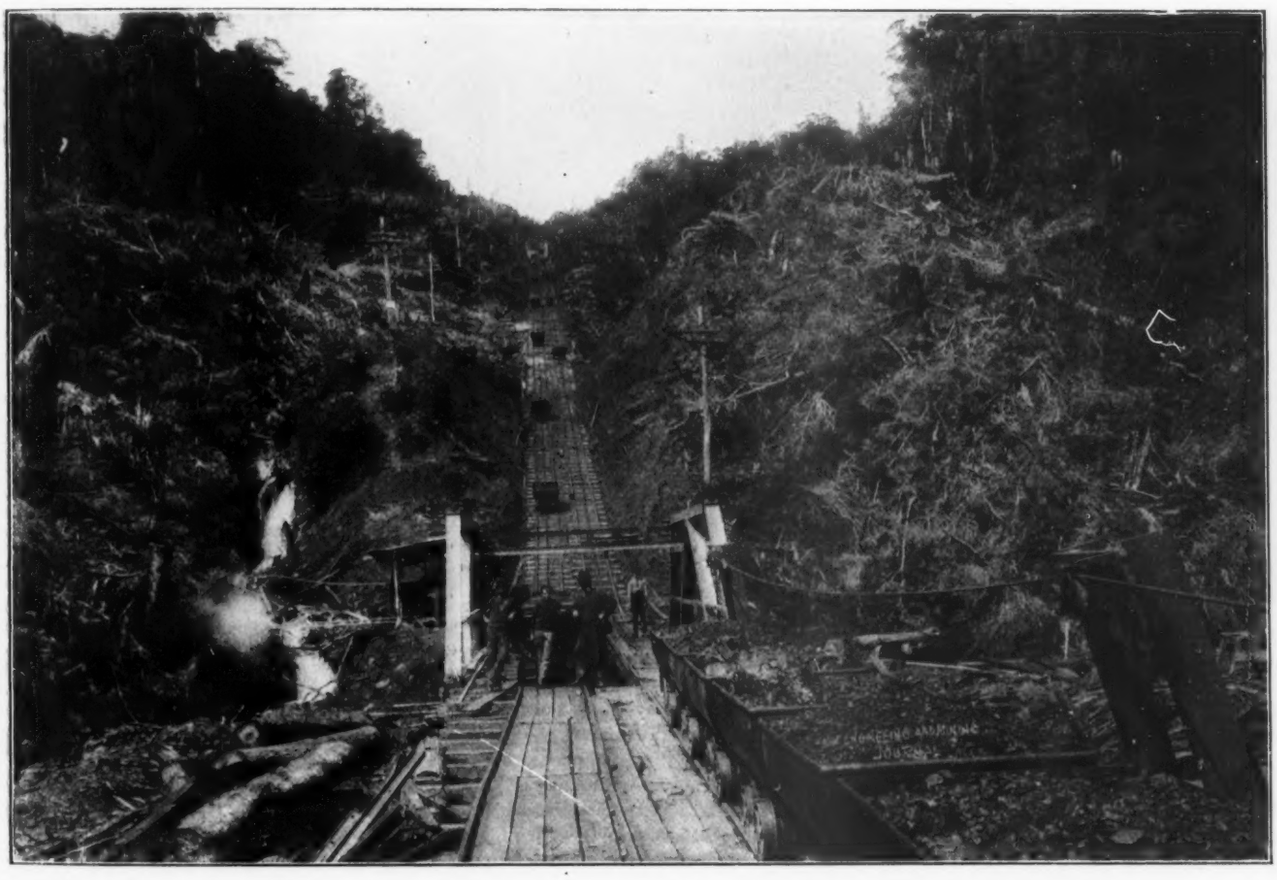


FIG. 1. SHOWING DOUBLE-TRACK ROPE INCLINE WITH CARS PLACED AT REGULAR INTERVALS ALONG THE CABLE

a local manifestation and that the two seams will soon unite, as they are simply different portions of the same main seam, and have been formed through the unequal rate of depression of a subsiding area, and of the rapid filling up of the more depressed part by sand or other sediment. Throughout the whole of the lease, the coal is lying at a very moderate angle of dip, and this together with the ample hight of the seam has warranted the adoption of large sized cars for the conveyance of the coal within the mine.

The coal is an excellent grade of bituminous fuel as will be shown by the following analysis:

Moisture at 100 deg. C.	= 1.20	per cent.
Hydrocarbons	= 36.60	" "
Fixed carbon	= 61.12	" "
Ash	= 1.08	" "
	100.00	" "

Some of the coal is comparatively soft and its structure laminated; often it is hard, compact and structureless, and stands handling well.

Method of Working

A main haulage road is being driven along the western boundary of the lease to its farthest extremity; here it will be opened out into a system of pillar-and-stall workings and the mine will be "worked home," the pillars being removed at the rear of the whole workings as early as safety and utility will permit. Like the rest of the mines in this locality, it will not be necessary to use safety lamps as the presence of inflammable gas, even a small quantity, is the exception and not the rule in these Westport mines; furthermore, the cracks caused by the settling down of the roof in the worked out areas, extend to the surface and afford ample opportunity for the escape of any free gas.

The coal is undercut by Sullivan machines; the transport of these machines from one part of the mine to another affords no difficulty on account of the moderate dip of the seam.

Ventilation

The main ventilation is effected by an electrically driven fan of improved Waddle type, actuated by a belt from an induction motor which is fed through an oil-cooled transformer taking current from a transmission line and reducing it from a potential of 6000 volts, down to 500 volts. Several electrically driven Sturtevant auxiliary fans are also in use. There will be as few stentons as possible, to avoid leakage of air and also to allow of panels being sealed off more effectively in case of fire.

Haulage Plant

The traction in the mine, and from the mine mouth down to the top of the rope incline, which is 2¼ miles from the mine mouth, will be done by electric motors. The main locomotives are 20 tons in weight and can control trains of 20 cars, each car being capable of holding 1½ tons of coal. Six-ton locomotives are used for serving the working breasts with empties and for feeding the main drawing roads with full cars. From the mine to the top of the rope incline, the gradient is in favor of the load and averages 1 in 21.2; the steepest part of this grade is 1 in 12. The formation has been made of double width, so that the present single track may be duplicated when required in the future; this plan will make it possible to transport 2000 tons of coal per day.

The sharpest curve on the tramway is 2 chains radius, and it is formed of 65-lb. steel rails laid upon ties of yellow pine (a local timber) except at curves and at points and crossings at which places imported hardwood ties are utilized. In addition to wheel brakes, the larger locomotives are fitted with Fell brakes for the operation of which each steeper gradient is provided with a center rail.

The overhead trolley system has been used both in the mine and outside, and a direct current of electricity with a voltage of 250 is employed. This involved a heavy first cost for copper, but was deemed advisable on the grounds of safety. The cars are lowered from the terminus of the electric tramway by means of endless ropes, and this is done in two stages. Both inclines are, of course, double tracked, the rails being 40 lb. to the yard. The haulage ropes are made of the best plow steel; that for the top incline being 4 in. in circumference and that for the bottom incline 4¾ in. The cars are attached to the ropes by Craven's patent screw clips and are spaced at intervals of 2 chains. Both upper and lower inclines have been carefully graded with an avoidance of sudden changes of grade; any change of grade from flatter to steeper, going down hill, being brought about by long vertical curves.

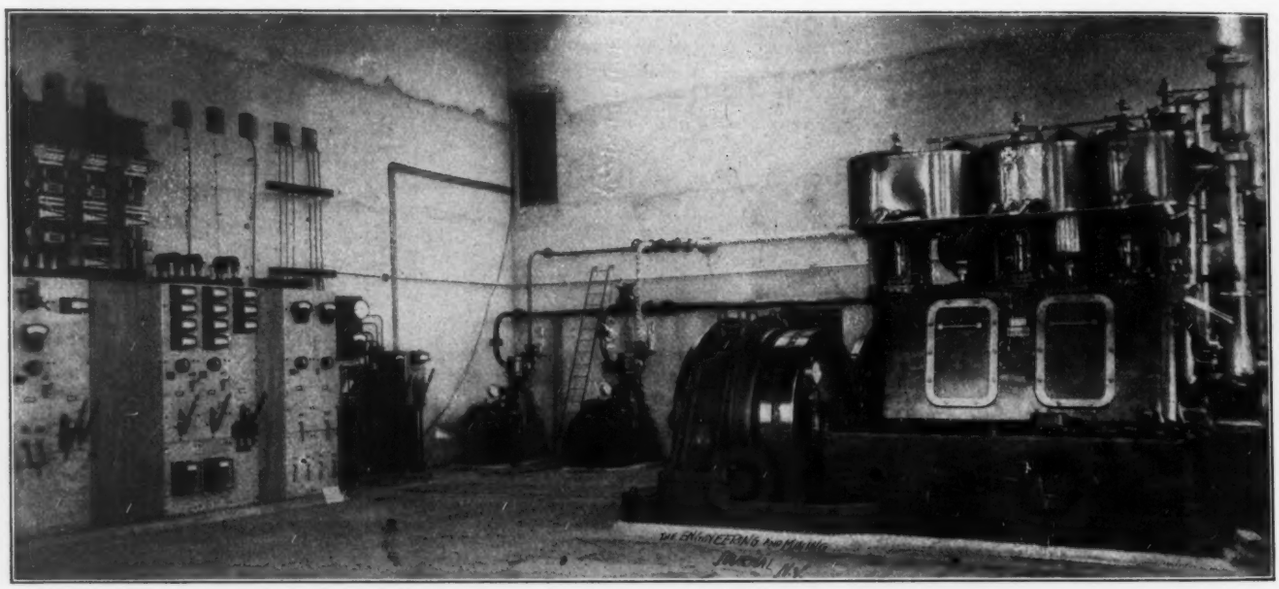


FIG. 2. SHOWING INTERIOR OF THE DYNAMO ROOM AT THE WESTPORT-STOCKTON COLLIERY

The upper incline is 40 chains in length having an average slope of 1 in. 6.7; the steepest part being 1 in 5. The lower incline is 33 chains long and has an average grade of 1 in 4 and a maximum of 1 in 3. The two inclines are separated by a short-changing level, and each incline has its haulage rope controlled by vertical 4-cylinder hydraulic brakes, and to avoid the excessive side-grinding which is a feature of Surging drums, vertical pulleys are used; these are 10 ft. in diameter; the braking pulley having 5 rope grooves, and the idler pulley 4 grooves. These brakes impart a very even movement to the rope which is given a speed of 2 miles per hour.

At the foot of the lower incline the cars

are transferred to a main-and-tail rope which draws them to the bins in trains, through a tunnel 7 chains in length, having a grade in favor of the load of 1 in 63. Through this tunnel the track is single and is formed of 40-lb. rails. The haulage power is given to the ropes by an electric hoisting engine driven by an alternating-current motor working at a potential of 220 volts; the transformer which steps the voltage down from 6600 to that of 220 is situated in the main power station.

Screening and Loading Plant

Ample siding accommodation has been made by the company, two miles of track having been laid out in shunting loops for the reception and quick despatch of the State railroad cars. On these sidings the coal bins have been erected; these latter are 50 ft. high, 100 ft. long, and in width span five railroad tracks; they are built of Australian iron bark on a pile foundation, having a total capacity of 5000 tons. They consist of three compartments, two with a capacity of 2000 tons each for the storage of unscreened coal, and one of 1000 tons capacity for the reception of nut coal.

The tipplers are large machines of the side-revolving type; the full car running in, bumps the empty one out and the latter is automatically switched back onto the empty road. In the pulling of a lever by the attendant, the tippler swings gently over and quietly deposits the coal onto a distributing jigger, and thence, in the case of No. 1 tippler, over an end-shaking screen, and a retarding conveyer belt, to the railroad car, in which the screened coal is dropped with the least amount of breakage. The nut coal from this operation is lifted to the nut bin and automatically distributed in the same way by two flight conveyers. The coal from No. 2 and No. 3 tipplers, after leaving the distributing jigger, passes onto a plate-band conveyer on which the coal is picked, and from which the unscreened bins are filled, the coal being lowered gently by means of alternate reversed chutes to save breakage.

The bottoms of the bins are provided with horizontal steel-plate sliding doors worked by means of hydraulic cylinders placed at each end of the bins, the pressure being obtained by an automatic accumulator. The plate-band conveyers, scraper conveyers, shaking screens, and distributing jiggers are all electrically driven by direct-current low-voltage motors.

The Power House

The power house is a building 174 ft. long, 50 ft. wide and 25 ft. high; walled with ferro-concrete and roofed with galvanized iron, and is divided into three rooms; the dynamo room, the condenser room, and the boiler room. The main generating engines are vertical triple-expansion steam engines having a high piston speed, and are oiled by forced lubrication. They are coupled direct to alternating-current dynamos, which generate a three-phase current at 6600 volts with a periodicity of 60 cycles per sec., at a speed of 400 revolutions per min. Each machine provides 300 kw. at 80 per cent. power factor.

The alternators are capable of 10 per cent. continuous overload, 25 per cent. for two hours, and 50 per cent. momentarily without undue heating or strain. Two of these generating sets are installed at present, and are calculated to provide sufficient power for an output of 800 tons of coal from the mine per day; however, ample room has been provided for two more sets which will bring the power sufficiently high for an output of 2000 tons per day.

Two small exciter sets are also used; these are driven by engines of the same type as the main generator engines, and are run at a speed of 600 revolutions per minute. They are used for the generation of direct current to excite the fields of the main generators.

In the dynamo room is also installed a 100-kw. motor-generator set which runs at a speed of 700 r.p.m., making current at 280 volts. This provides power for the screening and belt-conveyer machinery, also for the workshops and for lighting purposes. The switchboard is of blue-gray Vermont marble; the panels are fitted with ammeters, voltmeters, recording and indicating wattmeters, and a sensitively constructed Lyrrel regulator for automatically regulating the potential of the main generators.

All the alternating current switches are of the oil-break type and are placed in concrete cells at the back of the switchboard.

In the condenser room is a large surface condenser of Worthington make; this is fitted with an Edwards vertical-triplex air pump, and an 8-in. centrifugal circulating pump with high-speed engine. The surface in the condenser is 2600 sq.ft., and it is capable of condensing 30,000 lb. of steam per hour.

In this room there is a Worthington oil separator through which the steam passes on its way to the condenser; there is also a large hotwell, and a Webster vacuum feed-water heater which deals with the exhaust steam from the feed pumps and chain-grate-stoker engine. The boiler room contains four Babcock and Wilcox patent water-tube boilers, fitted with chain-grate mechanical stokers and with superheaters. The working pressure of the boilers is 150 lb. per sq.in., and each boiler has a heating surface of 1600 sq.ft., and a

FIG. 3. THE MAIN LOCOMOTIVES ARE 20 TONS IN WEIGHT, AND CONTROL TRAINS OF 20 CARS, EACH CAR HOLDING 1½ TONS

firegrate surface of 34 sq.ft. with an evaporative capacity of 5000 lb. of water per hour.

Provision has been made for the accommodation of more boilers when required. A Sirocco fan provides ventilation for the building, which is splendidly lighted in the day by means of large windows arched at the top and framed altogether in cast iron, the illumination at night being provided by both incandescent and by arc lamps.

Working Two Coal Seams in Close Proximity*

By Walter F. White

The following is a brief description of the method employed at present in working two coal seams which have but 3 ft. of strata between them:

The two seams have been previously worked by several methods and modifications, viz., (1) pillar and stall, (2) bottom seam first and top seam after, (3) *vice versa*, and (4) longwall—upper seam first. The two first methods resulted in great loss. The result of the last method was that when the lower seam came to be worked it was greatly deteriorated in quality and was rendered difficult to mine, especially in places that gave off water, which occurred somewhat frequently.

When a new district was required to be opened out last winter, another method, or rather another modification of longwall was introduced, by which the two seams are extracted practically by one working. The mode of procedure will now be described:

The section of the seams and their immediate strata is made up as follows: Lower seam (5 ft. thick) intersected at 3 ft. by a 6-in. band of shale, then 9 in. of inferior coal which is left and forms the roof of the lower seam. Above this is 2½ ft. of stony fireclay, on which rests the upper seam (3 ft., 6 in.) capped by 9 in. of sod or shaly clay, which generally falls with the coal. Over all this is a thick bed of not very strong metal, being full of slips and joints.

The modification of working is evident from the sketches, which show the succession of operations in the extraction of the coal.

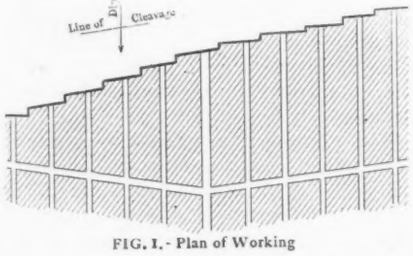


FIG. 1.- Plan of Working

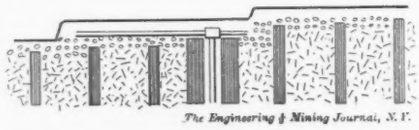


FIG. 2. PLAN SHOWING ONE GATE AND POSITION OF PACKS

There are five drawing gates on each side of the jig, stalls being about 36 yd. wide. Each stall is supported by from two to five rows of 4- to 6-in. diameter props, and a 2-yd. packwall at 6-yd. intervals. The lower seam is taken out in juds or lifts of 2½ yd. each. The packwalls are built in position immediately there is room; the three rows of props, which are farthest down in the goaf, are withdrawn; the inferior coal and fireclay then falls leaving the upper seam exposed to view, and unsupported, except by the packwalls and one or two props. We then at once climb on the fallen dirt, make it as level as practicable on its surface and set two or three rows of props to support the upper seam, placing flat pieces of wood under the props in addition to a broad cap at the head, to make them thoroughly secure.

Mining the Upper Coal

We next commence to cut down the upper coal, beginning down the pack side and cutting up to within a few inches of the sod overlying the seam. We find it much the better plan to leave 4 to 6 in. of coal and prop to it, as the sod is of a very tender nature and causes a serious loss of coal if it falls and mixes with it.

As we cut down the coal, the supporting props being drawn one by one, we of course set other props up to the roof or layer of coal that is left. As the coal falls, it is thrown down into the roadway at the face in the lower seam, or if possible it is filled into the car direct. A small portion of slack is lost by falling on the rough surface of the fallen fireclay.

At intervals of 5 or 6 yd. as we advance upward, openings are cut through the upper coal over the packwalls, to allow the ventilating current to sweep through, otherwise it becomes very hot in that portion of the face. Except where these openings are made, a rib of coal is left on the packs.

The fireclay is taken down in the gates, and when the face has advanced a short distance, the upper coal is also brought lower by the settling down of the whole strata above. The coal is then cut down in the gates, squared down by the pack sides and filled out.

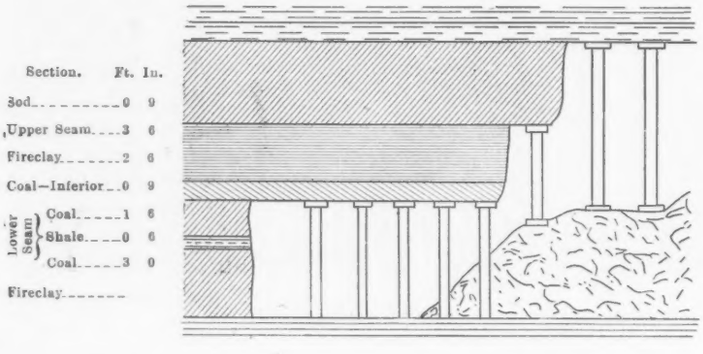


FIG. 3. SECTION SHOWING COAL FACE

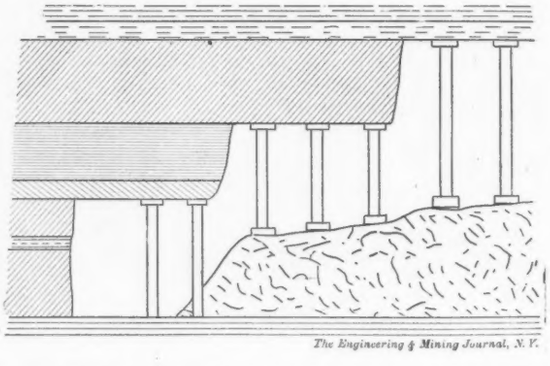


FIG. 4. SECTION OF FACE AFTER WITHDRAWAL OF BACK PROPS

Compared with the method of getting the two seams by longwall in two separate workings—that is, taking out the upper seam a jig length (100 yd.) in advance of the lower—this is a wasteful method of working the upper seam, as a fairly large percentage of coal is left and lost. When we consider the greater amount of round coal produced, however, the great saving in timber and general economy in working, it more than counterbalances the loss mentioned, and therefore has justified the change.

Twenty stamps to be installed at the West Rand Consolidated Company will be the heaviest on the Witwatersrand (*Aust. Min. Stand.*, Dec. 30, 1908). Each stamp will weigh 1850 lb. and have a duty of 12 tons per 24 hours.

*Abstract of an article published in *Mining Engineering*, February, 1909.

Data on Coal-mine Ventilation

Mine ventilation is a subject which has received a great deal of attention during the last few years, largely due to the fact that mines have increased in depth and in extent far beyond the original plans.

Small mines and those worked on a minor scale, could be ventilated by natural air currents, but the air shafts for natural ventilation must be large on account of the low velocities of air. As the mines increased in extent and depth, shafts were entirely too small for natural ventilation, and it became necessary to use mechanical means; in fact, without a mechanically driven fan it is impossible to get sufficient air through the extensive workings. While there is always a certain amount of natural ventilation, probably less than 25 per cent. of the total volume of air current is due to natural flow; the rest must be furnished by the fan.

Advantages of the Small High-speed Fan

The large volumes of air require a fan of great capacity, which may be obtained by a wheel of large diameter operating at low speed or by the higher speed of a smaller wheel. The small high-speed fan possesses many advantages. With a large low-speed fan an increase in volume is obtained at a speed which is liable to be detrimental to the construction of the heavy wheel, and the large fan is expensive to run for small volume. The small high-speed fan may have the speed increased without danger, for it is built for such service, and when run at reduced speed the cost of driving is not great. Again, the parts of a small high-speed fan are of less weight, and consequently more easily handled—important factors in installation and maintenance costs.

The driving of mine fans is a matter of importance. With a very large wheel making 30 to 60 r.p.m., direct-connection to motor or engine is out of the question; however, with a smaller fan running at 175 to 350 r.p.m. a powerful reliable set is obtained, especially for water-gages up to 5 in., by driving direct-connected.

The weight and dimensions of such apparatus are very moderate, and the efficiency of the set is high, for the engine or motor may be run at its most economical speed.

The Sturtevant centrifugal fan of the multivane type, is especially applicable for the ventilation of modern mines, for it is essentially a high-speed, large-volume fan. The manufacturers claim that this machine can be run at a higher speed with safety and economy than any other fan of the same capacity. It is a thoroughly up-to-date design for handling large volumes of air against resistances up to 5- and 6-in. water-gage.

The multivane type of wheel is made up of 60 or more shallow blades which are spooned to distribute equally the air pressure within the fan, and to increase the strength and rigidity of the wheel. The shallow blades permit large inlets, which contribute to high efficiency, because the friction loss of the entering air is a minimum. With a fan wheel of but few blades, the inlets cannot be as large if the necessary blade area to give the volume is maintained.

Details of Fan Construction

The substantial cast-iron hub or hubs are strong and of sufficient size to receive and hold rigidly the steel arms of T section which are cast therein, and securely riveted at the extremities to the fan blades. For the large wheels two or more sets of arms are used to secure greater rigidity.

The shaft is extra large to support the wheel without deflection, and special attention is given the bearings so that there will be no occasion for shut-downs. The wheel is carefully balanced to eliminate vibration. Usually the fan is of the type known as ¾ or ⅞ housing to reduce the hight of the shaft above the foundation, and is built of steel plate rigidly braced with steel angles and fastened to foundations of brick or concrete, of which material the inlet housings also are made. To secure a large volume without increasing the diameter of the wheel and consequently the hight of the fan, the housing and the wheel are usually made of double width. The small diameter also makes it possible to run the wheel at a speed suited to direct connection to engines, or electric motors.

The accompanying table gives the performance of Sturtevant mine fans for use for systems where air is blown into the mine; in other words the stated resistances are the static pressures existing at the fan outlet and measured in inches of water. For exhaust systems the fans require less horsepower to maintain a static suction at the fan inlet equal to the value given, and handle less air. This is due to the fact that in the blow system no allowance is made for the conditions existing at the inlet, while in fact a suction exists there.

For a given volume of air blown into the mine, the static pressure maintained at the fan outlet is that pressure caused by the various losses due to the resistance to air flow in the circuit, whereas with an exhaust system the static suction maintained at the fan inlet is that caused by the various losses in the air circuit added to the suction which exists at the fan inlet (but not taken account of) in the blow system.

Maintained Resistance.												
Fan No.	3-Inch Static Pressure.			4-Inch Static Pressure.			5-Inch Static Pressure.			Hight Above Foundation, In. ¼ Housing.	Width of Housing, Inches.	Length (at right angles to shaft), Inches.
	R.P.M.	Cubic Feet PerMin.	H.P.	R.P.M.	Cubic Feet PerMin.	H.P.	R.P.M.	Cubic Feet PerMin.	H.P.			
12	398 414	126,200 136,000	172 200	448 464	138,000 148,200	244 272	500 517	154,000 165,500	338 380	74½	80½	112½
13	362 377	152,800 165,000	208 244	407 422	167,400 180,000	296 328	455 471	187,000 205,000	414 458	82	88½	123½
14	332 346	182,600 197,000	252 292	373 387	199,800 215,000	352 392	416 432	223,000 240,000	492 547	88½	96½	135
15	306 319	214,200 213,200	292 344	345 357	234,400 252,200	412 460	385 398	262,000 282,000	575 643	95½	104½	146½
16	284 296	246,000 266,800	340 396	319 331	270,800 291,000	480 532	356 369	302,100 325,000	670 744	102½	112½	157½
17	266 277	283,000 306,600	392 456	299 310	311,000 323,000	552 612	334 346	347,000 361,000	771 855	109½	120½	168½
18	249 259	325,000 358,000	440 516	280 290	354,000 380,000	620 692	312 324	395,000 424,600	866 967	116	128½	179½
20	221 231	408,000 440,000	556 652	249 258	446,000 480,000	788 876	278 288	498,000 535,200	1100 1223	130½	144½	202
22	199 207	504,000 544,000	692 804	224 232	552,000 592,000	976 1084	250 259	616,000 661,000	1364 1515	143	160½	224

When economy is not essential, or in case of emergency, these speeds may be materially increased, resulting in much greater volumes. If less volume is desired than given above, the wheel and housing may be of one-half the width, giving practically one-half the volume and requiring one-half the horsepower.

Broken Hill Proprietary Company

In the last semester the zinc concentration plant treated 135,235 tons of material, producing 29,659 tons of zinc concentrate, averaging 15 oz. of silver per ton, 9½ per cent. lead and 44 per cent. zinc. Finer grinding by means of tube mills, as compared with ball mills, increased the extraction. The Port Pirie smeltery treated 125,784 tons of ore, producing 48,350 tons of bullion. The refinery treated 48,368 tons of bullion, producing 2,589,416 oz. of silver, 1054 oz. of gold, 47,833 tons of desilverized lead and 470 tons of antimonial lead. Gas firing in connection with the roasting furnaces has given satisfaction. The first zinc distillation furnace has been completed and nine more are to be erected. Suitable clay for making the retorts has been discovered in the vicinity. It is expected that eight furnaces will be in operation by the end of 1909.

Present Position of the Steel Rail Question

The new specifications for rails issued by the larger lines include chemical requirements for open-hearth rails, and the orders are usually for as large a tonnage of this grade of steel as the mills are prepared to supply within the time limits. The growth of the open-hearth rail manufacture in the United States has been rapid. In 1903 only 45,000 tons were rolled. In 1907 the amount rolled had increased to 252,000 tons, and in 1908 to 567,000 tons. The bessemer rail production reached its maximum in 1907 when 3,380,000 tons were rolled, while in 1908 it was the smallest since 1897, less than the average for the 10 preceding years, and only 1,354,000 tons. The open-hearth rails rolled in 1908 equaled 42 per cent. of the bessemer. The present capacity of the steel works in the United States for the manufacture of open-hearth rails, including the new Indiana Steel Works just going into operation, is nearly 2,000,000 tons, or about 50 per cent. of total new-rail requirements in prosperous years.

The Pennsylvania Specification

The new Pennsylvania specification makes no change in the chemistry for bessemer rails, but adds a second classification in the chemistry of open-hearth rails. The previous specification of April, 1908, made 0.03 phosphorus and 0.80 carbon the upper limits, while the new one makes the upper limits for Classification A, phosphorus 0.03 and carbon 0.083; for Classification B, 0.04 phosphorus and 0.75 carbon. The desired carbon for the two grades is 0.75 for the lower phosphorus, and 0.70 for the higher, thus following the general law that for each 0.01 per cent. phosphorus added the carbon should be reduced 0.05 per cent. on account of the brittleness due to excessive carbon and phosphorus. The reason for making two classifications for open-hearth rails relates principally to the cost of manufacture. It was thought desirable to specify phosphorus as low as 0.03 so that high carbon could be used and the wearing quality of the rails, particularly on curves, would be materially improved. But the extra time required in the open-hearth furnace to reduce phosphorus from 0.04 to 0.03 results in some increase in the cost of manufacture, and a slight addition to normal price per ton is added for the Class A rails.

A clause has been added which excludes ingots that have been so overheated that the scale on the sides becomes liquid.

The requirements under the drop test are less rigid than those of the previous specification, and some concession has been made to the manufacturer in this particular which is not likely to insure better rails so far as the brittleness of bessemer rails is concerned. The former requirement was that "if a test piece breaks under the drop without showing physical defects all rails made from that heat shall be rejected absolutely." The present provision permits of a retest after failure of the first, allowing two more pieces from the same heat to be tested, and if neither of these fails the rails are accepted as No. 1 or No. 2, according to the deflection. If either of the second test pieces fails all rails from that heat will be rejected. The provision that drop testing shall be continued to the destruction of the specimen in case the first piece breaks without showing physical defects, is an added precaution which should result in a material benefit to the railway by reducing the number of piped rails which, in spite of the usual inspection and tests, get into the main track. This new feature in drop testing has been obtained by some concession to the railmaker, as it is agreed that if the test piece does not break under ordinary conditions, but when nicked and tested shows pipe, the top rail from each ingot will be accepted as "special" rails, and marked differently. These rails will be regarded as inferior and not used in main-line track. For open-hearth rails it is required that makers shall furnish inspectors with complete chemical analysis for each melt.

The Baltimore & Ohio Specification

The new Baltimore & Ohio specification for bessemer rails, dated Jan. 25, 1909, is similar to the Pennsylvania in chemical requirements, but for open-hearth the chemistry is somewhat different. The upper limit for phosphorus is made 0.04 for all rails made by that process. Manganese is allowed as high as 1 per cent. and carbon 0.80 per cent. This specification also allows retests. It provides that drop tests shall be made of two test pieces of rail rolled from the top of different ingots, and if either fails a third piece shall be tested. The new Pennsylvania railroad specification requires the drop-test pieces to be cut from the rail bar next to either end of the top rail. The Baltimore & Ohio also requires the drop test to be carried to destruction so that an examination can be made of the fracture and pipe or other interior defects can be detected; and acceptance of the rails is based on the clean fracture as well as the amount of deflection. The effort to enforce the discard of a certain per cent. of hight of ingot to eliminate segregation appears to have been abandoned and the new specifications now simply require that there shall be sheared from the top of the ingot sufficient discard to insure sound rails.

Canadian Rails

The Canadian Pacific has prepared a new specification for rails which is interesting because it is intended to meet the severe winter conditions of Canada where the track is frozen rigid for long periods. It was prepared also with special reference to the conditions of rail manufacture in that country. Two rail mills in Canada have a capacity about equal to the ordinary requirements of Canadian railways. The Dominion Iron and Steel Company at Sidney, N. S., manufactures basic open-hearth steel only. The product of the Algoma Steel Company at Saulte Ste. Marie, Ont., is 75 per cent. acid bessemer and 25 per cent. basic open-hearth. The bessemer rails have only 0.085 phosphorus and the average carbon is 0.58 and for open-hearth steel the upper limit for phosphorus is 0.06 and the lower limit for carbon 0.60. The standard section for new rails on the Canadian Pacific is 85 lb., and this is preferred to the 100-lb. rail on account of the unfavorable experience due to square breaks with the 100-lb. rail having American Society of Civil Engineers section. This decision is based upon the fact that the 80-lb. section, having identical chemical composition under the same traffic and like climatic conditions, did not break as frequentiy. The Canadian Pacific has in track now 85,000 tons of the new 85-lb. rails. In their manufacture it was found that when they approached the saw they were of more even temperature in all parts of the section, the rail head being cooler than in the old section. Therefore, a finer grain of steel was produced, having better wearing qualities. The more equal distribution of material between the head and the base simplified the cold straightening to such an extent that it required 40 per cent. less work than the old section with its thin flange and thick head. The straightening of the rails under the cold press seriously impairs their strength and is one of the principal causes of fracture. If the 100-lb. rail had been given the advantage of a better balanced section it also could have been rolled with a cooler head and would have required less cold straightening and given better service.

The Canadian Pacific drop test for open-hearth rails is more severe in most of its provisions than those already mentioned. It requires that from each 50-ton heat three rail butts shall be tested, and each butt must be taken from the top end of the first, middle and last ingots cast of each heat. The supports are 4 ft. apart and the hight of drop is 20 ft. for the 85-lb. section. If two of the test pieces are not broken and show a deflection of less than 3¼ in. the heat is accepted. If two fail it is rejected. There are no retests, and less is left to chance than is in most of the rail specifications used in the United States. The practice as to discards in Canada also appears to be more definite and satisfactory than in the United States. After cutting off sufficient to square up the end, at least 12 in. more of seemingly solid steel is cut from that end of the bloom, and if the steel does not then look solid the cutting must continue until it

*Abstract of article in the *Railroad Age Gazette*, New York-Chicago, March 19.

does. In the same specification the drop test for bessemer rails is 18 ft. and the minimum deflection 3¼ in. A rail butt from every third heat is taken from the top end of the first ingot. If it fails a second test is made and if that fails all rails made from that heat are rejected.

Other Specifications

The Santa Fé received last year a supply of open-hearth rails from the Bethlehem Steel Company, and they were among the first rolled by the new mill. The specification required 0.04 phosphorus and 0.60 carbon. The section is a special one having a weight of 85 lb. per yard.

The Burlington has ordered a large tonnage of open-hearth steel and adopted the 90-lb. section, Series A, recommended by the American Railway Association. Its specification requires that there shall be sheared from the end of the bloom formed from the top of the ingot 9 per cent. discard, or until sound metal shows on the end of the sheared section. "The chemical composition shall be within the following limits: Carbon, 0.55 to 0.65; manganese, 0.75 to 1; silicon, not to exceed 0.20; phosphorus, not to exceed 0.06. For every point (0.01) phosphorus is reduced below 0.06, carbon may be increased four points (0.04), the maximum carbon to be 0.80." The requirements in the drop test provide that at least two test pieces shall be selected from each heat by the inspector, and the hight of drop for the 90-lb. rail is 19 ft. If the first test piece breaks then two others from the same heat are tested and if either of these fail all the rails from that heat are rejected. If both meet the requirements, then the rails from that heat will be accepted. It is also provided that rails shall not vary throughout their entire length more than 5 in. from a straight line in any direction when delivered to the cold straightening press. Those which vary beyond that amount are classed as second-quality rails.

Piping

Inspectors using the new Pennsylvania rail specifications have discovered quite a large percentage of piping. Testing to destruction discloses such piping even in the tests that had failed to break under the drop, thus clearly indicating that there must have been a large number of piped rails delivered to the railway companies under former practice. The railmakers have been much disposed to contradict the possibility of a large percentage of piped rails existing; in fact, have in many cases taken the position that undue stress had been placed upon that defect. Some authorities, for instance, have argued that with many failed rails the defects which have been classed as pipes have really been caused by the presence of slag which, under the strain of traffic, had acted as a wedge splitting the steel. While that may have happened in some cases, many failures causing accidents have been due to pipes, and some method of inspection should be used to detect them.

General Progress Made

In conclusion, it is evident that the rail question in general is in an experimental stage, but making satisfactory progress toward improved standards. The new sections with a heavy base having a larger area than the head, have already shown important results in reducing cold straightening and in producing a finer steel structure due to cooler rolling. The open-hearth steel, with phosphorus less than half that in bessemer, will largely reduce rail breakages due to brittleness. The drop tests must be readjusted to suit the testing machine with a standard anvil and definite foundation. The one important matter which remains unsettled and indefinite is that relating to discard, segregation and the other items which affect the structure of the rail by producing pipes and similar imperfections. These will be found as frequently in open-hearth rails as in bessemer, and the best safeguard thus far proposed is testing under the drop to destruction, so that the fracture may be examined. This feature must, therefore, become an important part of a good rail specification even at an extra cost per ton.

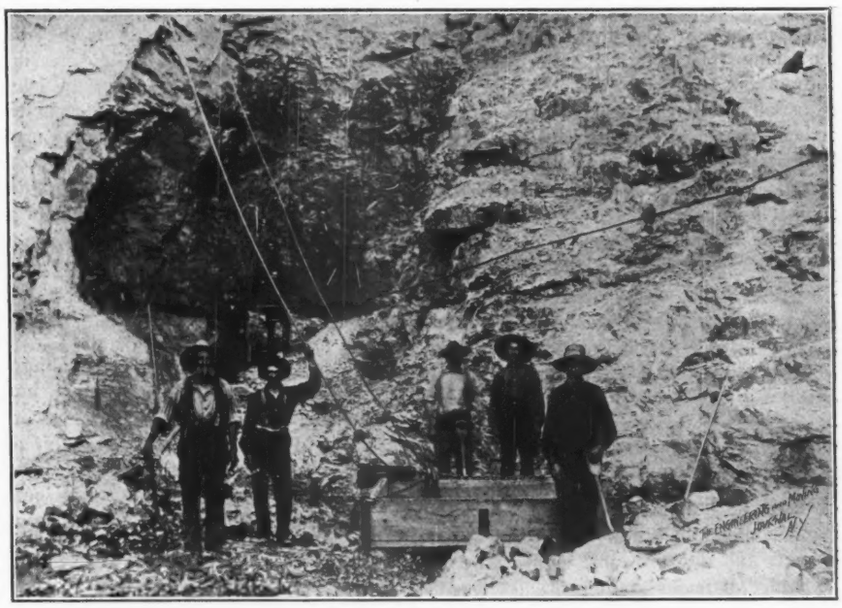
Rhodesian Gold

Gold production in Rhodesia in February is reported at 45,744 oz. fine, a decrease of 2877 oz. from January. For the two months ended Feb. 28 the total was 94,365 oz., or $1,950,566. This is a decrease of $79,311, as compared with the corresponding period last year.

Feldspar Mining in Ontario

By Cajetan Morsack*

In various portions of the Province of Ontario there are extensive ridges of feldspathic rock. Frequent outcroppings make it possible to trace these ridges for many miles. In texture the rock ranges from a coarse-grained granite to a rock consisting of little else than pink or white feldspar intermixed with some quartz. Among these ridges are found valuable deposits of feldspar, such as are being mined at present in Frontenac county, more particularly in Laughborough, Bedford and Portland townships. For profitable mining the deposit must be large, easily mined, reasonably free from impurities, and so situated as to be readily brought to the mill.



STOPE AND HOISTING ARRANGEMENT, RICHARDSON MINE, BEDFORD TOWNSHIP, ONTARIO

Nature of the Deposits

The feldspar occurs in more or less distinct veins in the Archæan gneissoid granite, with usually a capping varying in thickness from a few inches to many feet. This capping is more often a granite or "feldspar rock," but in some instances is a hornblende or mica schist. Accompanying the feldspar there may be distinct veins of practically pure quartz which extend above the spar and may form part of the capping material. These veins of quartz are usually quite large, from 1 to 10 ft. wide, and varying in depth. The vein of feldspar varies in widths from a few feet to 40 or 50 ft., or even more in exceptional cases. Few mines have been worked to the bottom of the deposit, but a depth of 50 ft. has been attained at the Richardson mine with ore at the bottom.

*Superintendent, Verona Mining Company, Verona, Ontario.

The veins of feldspar cross the strike of the mica schists and granites in which they are found more or less obliquely. Sometimes two or more veins having different directions will intersect. Some are very irregular in outline while others run in practically a straight line for several hundred feet with sharply defined vertical walls. Usually the vein may be traced quite readily by the depression between the granite walls, since the latter almost invariably rise to a greater hight than the vein material, a natural consequence of their greater resistance to weathering.

The criterion of good feldspar is its crystallization, luster and perfect cleavage. Spar containing free silica, or what the miners call "sandy spar," must be rejected. Usual impurities are quartz, mica, hornblende, tourmaline, and pyrite. Of these pyrite usually occurs in seams in the spar or occasionally in small pockets. Mica, tourmaline and hornblende occur in well defined crystals through the spar. The last two have received from the miners the name "black jack." The veins are without doubt segregations. The mineral is usually orthoclase, or the pink soda-orthoclase perthite, consisting of interlaminated orthoclase and albite. The presence of a good body of clear flint or quartz is usually taken as a healthy indication of the absence of any great quantity of the mica, pyrite and other basic impurities.

Methods of Mining

Feldspar deposits of this region are all mined by open cut. The soil is at most not more than three or four feet deep. This is stripped off, the capping removed, and the spar mined by stopes, usually 10 or 12 ft. to a stope. At the Freeman and Bauder mines the ore is hoisted in wooden buckets and dumped upon a pile, later to be hauled by teams to the railroad. At the Richardson mine, as shown in the accompanying illustration, the ore is hoisted by means of a cable to the top of the hill, where the buckets are loaded directly upon special mine cars operating on a self-acting incline by means of which they reach barges and are towed across the lakes to the railroad.

On account of its perfect cleavage the feldspar is easily mined, as it breaks readily into nearly rectangular prisms of practically a uniform size. These are shoveled into the buckets, and usually there is one man for each bucket who picks out any refuse or impure material. Formerly the ore was "forked" but this practice has been almost wholly abandoned. Where a good body of pure white flint is encountered this is saved and sold for use as a flux.

Drilling is done almost entirely by steam. As yet no drifting has been done, and whether this is practicable where the capping is very thick is problematical on account of the ease with which the spar is shattered. This would also mean a change in power on account of the ventilation problem.

Where it pays, the impure material is cobbed, but on account of the low price of the product and the relative high cost of mining and transportation, spar which needs constant cobbing cannot be mined at a profit. Little trouble is had with water. In most cases there is scarcely more than enough to supply the boilers.

Transportation and Costs

The serious difficulty in mining feldspar deposits in this section is transportation. The distances around the lakes are so great that no attempt is made to haul in summer. In winter the frozen lakes and swamps afford a good level road for the greater part of the distance. The lakes are valuable assistants in the haulage at the Richardson mine. It may be readily seen how largely the cost of transportation enters into the total cost of production where this item alone ranges from 45 to 80c. per ton, depending on the distance. In some cases where it is feasible the ore is taken by boats across the lakes to some point on the railway, thus affording a cheaper method of transportation.

In this section the cost of mining runs from $1.10 per ton loaded on the cars at the most favorably situated mines, to as high as $2.75 per ton at smaller mines less favorably situated. It is obvious that one problem needing serious attention is that of transportation to railway points, and where the deposit is of sufficient importance to warrant it, this is being more thoroughly looked after.

Practically all the feldspar from this region is used in the pottery industry, hence the desirability of keeping out iron compounds as these produce yellow or brown spots on the finished ware.

Boston Consolidated Mining Company

The Boston Consolidated Mining Company, in its fiscal year ending Sept. 30, 1908, produced from its Sulphide mine 79,300 tons of ore containing 7447 oz. gold, 55,705 oz. silver and 3,459,911 lb. of copper. The cost of mining, including development, was $183,992; transportation to smelter, $43,613; smelting, $217,049; freight and refining charge on bullion, $60,188; total, $504,841. There was deducted for losses in smelting and refining 249,880 lb. of copper and 6573 oz. of silver. After crediting value of gold and silver, the cost of the copper delivered at New York was 10.22c. per lb. At the Porphyry mine, the first shipment of ore mined by steam shovel to the Garfield mill was made on Jan. 15, 1908. As the shovels removed the capping they exposed an unlooked-for grade of ore, satisfactory as to copper content, but high in iron pyrites, which greatly reduced the ratio of concentration. Underground development subsequently proved that not over 16 per cent. of the payable orebody is included in this class of iron ore. Steam-shovel work was gradually suspended as the ore became available from underground working. During the year 411,175 tons of stripping were removed at a cost of 17.72c. per ton. The amount of ore mined by steam shovels and shipped to the Garfield mill was 26,647 tons. Meanwhile, underground developments were made with a view to the inauguration of mining by the caving system. In the course of this development work 128,391 tons of porphyry ore were obtained. The first section of the Garfield mill was put in operation on January 27, 1908. Only four sections were operated until September, 25, when four more were put to work. The mill recoveries ranged from 70 to 72 per cent., and milling cost was reduced from a maximum of $1 per ton experienced in the first few months of operation to 47.2c. per ton in September. The total cost of the mill to date is $1,568,604. The mill treated 143,284 tons of ore, producing 9935 tons of concentrate, containing 397 oz. of gold, 4967 oz. of silver and 2,937,599 lb. of copper.

Sidney J. Jennings, consulting engineer to the company, made a report under date of Dec. 1, 1908, in which the states that the Porphyry mine has 27,889,000 tons developed of ore averaging 1.52 per cent. copper, besides 9,550,000 tons averaging 1.23 per cent.

He estimates that the ore will be mined by steam shovels for 31c. per ton and by the caving system for 70c. Both methods will have to be employed. The capacity of the mill is estimated at about 1,000,000 tons per annum. Ratio of concentration will be 13 to 1 and the concentrates will assay approximately 14.4 per cent. copper.

On the supposition that one-half of the ore will be mined underground and one-half by steam shovels, the cost of production will be as follows: Mining, 50.5c. per ton; transportation to mill, 28.7c.; milling, 40c.; smelting and refining charges, 70c.; general expense 10.2c.; selling commission, 3c.; interest on bonds, 10.3c.; total, $2.127; this cost will decrease as the proportion mined by steam shovels increases. The recovery of copper from the average ore should be 19.5 lb. per ton, and the cost delivered at New York with allowance for gold and silver, 10.5c. per lb. Up to Sept. 30, 1908, the company had expended a total of $3,078,499.83, of which $135,197 was for porphyry developments; $488,484 for steam-shovel development; $1,600,483 for Garfield mill and shops; $91,668 for steam-shovel equipment; $136,028 for steam-shovel railway; $86,800 for gravity tramway; $137,758 for railway extension.

Delaware, Lackawanna & Western

The Delaware, Lackawanna & Western Railroad Company, besides a system of railroads extending from New York to Buffalo and Oswego, owns a large coal estate in the anthracite region in Pennsylvania. The company—unlike most of the anthracite-carrying companies — operates its coal properties directly, and not through the medium of a subsidiary corporation. The report is for the calendar year 1908.

The Coal Department statement of tonnage for the year is as follows, in long tons:

	1907.	1908.	Changes.	
Stocks, Jan. 1.....	602,939	590,089	D.	12,850
Mined and bought	10,371,341	10,314,359	D.	56,982
Total.....	10,974,280	10,904,448	D.	69,832
Coal sold.....	10,384,191	9,610,127	D.	774,064
Stock, Dec. 31..	590,089	1,294,321	I.	704,232

Coal sales, with the average prices realized, were made up as follows in 1908: At mines, 101,057 (average $2.32 per ton); company's supply, 1,377,708 ($0.98); local agencies, on line of road and at tide, 5,789,685 ($3.75); foreign agencies, off line of road, 2,341,677 ($6.35); total, 9,610,127 tons, at an average of $3.97 per ton.

The income account for the year may be stated as follows:

	Tons.	Amount.	Per Ton.
Coal sales.....	9,610,127	$38,185,417	$3.97
Increase in stock...	704,232	1,413,493	2.01
Total receipts.....	10,314,359	$39,598,910	$3.84
Coal mined & bo'ght	10,314,359	$17,063,059	$1.65
Transportation, Co.'s line.....	8,388,315	14,318,780	1.71
Transportation, other lines..... ...	2,745,807	2,014,738	0.73
Handling and selling	7,933,179	1,392,212	0.17
Improvements.....	.....	252,828	0.02
Taxes.....	.....	390,500	0.04
Total expenses....	10,314,359	$35,432,117	$3.44
Net earnings.....		$ 4,166,793	$0.40

Disregarding the coal added to stock, which is credited at cost price, the profit on coal sold was 57c. per ton. The cost of coal at mines was 48.2 per cent. of expenses; transportation, 46.1; handling and selling, 3.9; mine improvements, 0.7; taxes, 1.1 per cent.

The report of the railroad shows coal carried as follows: Anthracite, 9,971,061 short tons; bituminous, 1,018,872; coke, 95,156; total, 11,085,089 tons, a decrease of 624,029 tons. Of the total earnings of the railroad 43.7 per cent. came from the transportation of coal. The average haul on coal in 1908 was 190 miles; the average rate received 0.861c. per ton-mile. The coal rate was 0.153c. per ton-mile greater than that on merchandise traffic.

The report says: "The results of the coal operations, while not equaling those of 1907, are gratifying, in view of the widespread business and industrial depression. The cost per ton of mining and preparing coal for market was higher than in 1907. As heretofore explained, this yearly increase in cost, due to physical conditions, is a feature of the industry common to all mining companies, and is a matter of importance and interest to all consumers of anthracite.

"The company's mining operations were conducted throughout the year with success and were remarkably free from accidents of a serious character, for which much credit is due to all connected with these operations. The expenditures made for improvements of an extraordinary nature were somewhat less than in recent years, but were ample to maintain the mining properties in a high state of efficiency and in condition, as to new development, to increase the output of coal from them sufficiently to meet to a reasonable extent increased market requirements.

"The total coal sold during the year was less by over 700,000 tons than during the previous one. As the tonnage produced and bought was substantially the same as in 1907, the decrease in sales is represented by the larger stocks of coal on hand at the close of the year, which about equaled the decrease in sales. Of the increased stock of coal on hand a larger percentage was of the small or steam sizes than is ordinarily the case. This was owing to the marked depression in the industrial activities of the year. The reduced quantity of anthracite coal used by the company itself also contributed to the accumulation of small sizes thereof on hand at the close of the year.

"The prices of anthracite coal established in 1902 have been generally well maintained in all markets throughout the year and the industry continues on a steady, healthy basis.

"The accumulation of stocks of coal before referred to, which is general with all the companies interested, is not considered alarming by them, in view of the fact that on March 31 the existing arrangement with the mine employees, under which wages were fixed in 1906, will expire by limitation and there is a possibility that, as in 1906, the miners may suspend work pending the outcome of future negotiations. Should there be such suspension of mining operations, it will be readily seen that the accumulated stocks of coal will be required to amply protect consumers, pending the resumption of work.

"The company's mine employees have been prosperous and apparently contented during the past year. They certainly have suffered less from the depression of general business than any other important class in the country. This fact, however, does not seem to have in the least influenced the leaders of the labor organization with which they are chiefly identified as respects the character and extent of the demands they have decided to make for increased wages and other concessions from their employers, the anthracite companies. For the most part these demands are the same as were urged before the Anthracite Strike Commission in 1902 and were, after full hearing, denied by it as being unjust and unreasonable. The conditions at present existing are not changed to any extent from what they then were, nor can there be any reasons now urged why these demands are more reasonable or just now than then, and they cannot, therefore, be seriously considered.

The important question of whether this company, in common with others similarly situated, may continue to own and operate coal properties, and mine, purchase, transport and sell coal in the future as it has during the past 50 years, although forbidden to do so by the so-called "commodity clause" of the Interstate Commerce law, is now pending before the United States Supreme Court on appeal taken and argued recently from a decree of the Circuit Court of Appeals, which in a case brought by the Government to test the legality of the act, confirmed the right of the company to continue its coal business as heretofore. It is confidently expected that the Supreme Court will affirm this decision."

Brazilian Monazite

Monazite sand from the interior of Brazil contains from 4 to 5.7 per cent. of thorium oxide, while that from the sea coast may contain as much as 7 per cent. Brazilian monazite is magnetic, which fact renders it easy to clean. It has been found in commercial quantities only in alluvial deposits in the States of Rio de Janeiro and Minas Geraes and along the coast, from Rio to Bahia. Its original occurrence is in certain felspathic rocks, pegmatite, syenite, and gneiss, in which it constitutes from 0.07 to 0.2 per cent. of the weight. The present deposits have been derived by erosion and concentration of such rocks.

The interior deposits are found in the beds of dry water courses in the form of gravel and sand containing not more than 2 per cent. monazite, together with quartz, garnet, ilmenite and other heavy minerals. The deposits sometimes lie on the surface, and sometimes under a bed of clay as much as 3 m. thick. The sand is mined and concentrated roughly, and is finished on electro-magnetic machines, which make a 95 to 96-per cent. monazite product containing, on the average, 3.7 per cent. thorium oxide.

The early development of the beach deposits by Gordon, and the subsequent retraction of his concession by the Brazilian government, which had not been aware of the value of the deposits as a source of revenue, is well known. The government has even considered the possibility of establishing a chemical manufacturing industry for the preparation of thorium nitrate within its own boundaries, and it is reported that the State of Santo has granted a mining concession to Israelsohn & Co., with this object in view.

The Coal-Mining Situation in Indiana

The national executive board of the United Mine Workers of America will convene in Indianapolis, Ind., March 24. The meeting is called to consider general conditions in the coal-producing States, including Nova Scotia. There is a probability of a clash between the Indiana operators and the miners over the 3¼-in. drill-bit law passed by the recent legislature. It is stated the operators will refuse to sign a wage scale for next year until the miners have agreed not to demand the large bits, and as a large proportion of the men desire to use bits, a stubborn controversy is likely.

It is claimed by the operators and affirmed by James Epperson, mine inspector, that the legislature by enacting the law, crippled the coal industry in Indiana more than it thought. Under the former law prohibiting the use of the large bit, the industry of the State made greater progress than at any time in its history. The reports for 1907 and 1908 show that the miners of Indiana made more money, produced more coal and had altogether better years than they had ever before experienced in the history of Indiana coal mining. There were fewer accidents and deaths from accidents than ever before, which is attributed to the use of the smaller bit and rigid enforcement of the mining laws.

The new Indiana law permitting the use of the larger bit is dangerous, and while the controversy is on, it is significant that five men were killed March 19 by a windy shot which occasioned an explosion in the Sunnyside mine near Evansville. The disaster was due to an extra large charge made possible by the use of the large drill. The operators are hopeful of inducing the men to forego the privilege of using the larger bit from both an economic and hazardous basis.

James Epperson has been reappointed State mine inspector for Indiana by State Geologist W. H. Blatchley. Mr. Epperson has already begun an agitation for an "oxygen helmet" station in Terre Haute, the most central point in the bituminous field. It is his purpose to have the operators of the field join in the purchase of six or more of the helmets, and to have the city of Terre Haute supply the station. The helmets are sold at $250 each.

Would Prevent Loss

The interest of the operators is attracted to the helmet because it is considered an economical appliance. According to the statistics in the office of the State mine inspector, scarcely a day passes that there is not a bad mine fire somewhere in the State. These fires last for weeks in most instances, always causing a cessation of work in a part, if not all, of the mine.

"As a rule," said Mr. Epperson, "the heat from these fires is not so great as to prevent the miners from going to the places where the fire is burning, but the gases generated keep them back. By means of the helmets the men could go to the seat of the fire and be able to cope with it. Thousands of dollars annually could be saved by the operators by means of the appliances."

"By establishing a substation in Terre Haute," said Mr. Epperson, "and equipping it with a half dozen or more of the helmets, we would have them within an hour's journey of all the big mines of the Indiana field. By special arrangements with the steam and electric railroads, even this time could be shortened. My plan is to construct a gas tank in the station, where the operators and miners may be shown that there is absolutely no danger connected with the use of the appliance. After these demonstrations I would have the United States Geological Survey send men to the district to instruct the mine superintendents and fire-bosses in the use of the devices."

Mr. Epperson donned one of the helmets at the Urbana station and worked in a glass tank of deadly gases for several minutes.

"A man could don one of those devices and dig coal," he said. "The only handicap is the 35 lb. of weight added."

Colliery Notes

It is a good rule to require that no holes shall be charged for a longer period than 30 min. before being fired.

It is generally advisable to have a rule forbidding the firing of any shots until the face is either sheared, mined or undercut, not less than 3 ft. deep. It is also best to prohibit the firing of any shots when the bore holes used for firing extend beyond such undercutting or open end.

Experience continues to demonstrate that 6 per cent. of the value of a coal company's plant and equipment is necessary to fully maintain its efficiency, and either replace the investment in cash, when exhausted, or in kind, in new mining territory when needed, without further capital provision being necessary; and until so used the credit remaining should continue available for working capital.

The best opinion advises against the practice of having two shafts connected together by a wooden arrangement on the surface. When the two shafts are connected, a fire in one is then easily communicated to the other shaft. It is probably true that at a majority of our coal mines, the downcast and the upcast shafts are connected on the surface by gangways of wood. Our laws do not forbid this practice; however, it is a point that should be considered by mine operators in building new plants.

For draining underground workings, located a considerable distance from the shaft, nothing is more suitable than the three-throw electric-driven ram pump; the machine should be designed to keep the velocity of the water on the suction side down to 3 ft. per sec., and the velocity in the delivery pipe should never exceed 6 ft. per second. In this connection it should be remembered that it is better to keep the plunger and valves large, and the stroke short, with a higher speed, in preference to a long stroke and a slow speed.

Before the Société de l'Industrie at Paris recently, M. Siegler stated that at a coal mine in the Loire district, France, the cost per ton of producing coal in 1855 and 1907 compared as follows:

	1855	1907	Increase
Labor underground...	$0.59	$0.95	$0.36
Labor on surface.....	0.12	0.26	0.14
Supplies	0.25	0.79	0.54
Total mining cost..	$0.96	$2.00	$1.04
General expenses.....	0.51	0.66	0.15
Total	$1.47	$2.66	$1.19

The average quantity of coal per miner per year had not changed, being about 230 tons in each year.

There are many precautions to observe when a heading is approaching old workings. Besides keeping a center bore-hole 25 or 30 ft. in advance and flank boreholes about 15 ft. ahead, there should be preparations to deal with any water or gas that may be encountered. A good supply of dry fir plugs, 4 or 5 ft. long, should be provided and when water is tapped, one of these plugs should be driven tightly into the hole, and a post wedged up in front to prevent the water pushing it out. It is also sometimes advisable, when there are signs of water percolating through into the hole, to insert a pipe with a valve through which the boring rods may be passed and the boring continued. As soon as the water is tapped the rods may be withdrawn and the valve closed thus preventing the sudden inrush of the water.

At one of the mines in southern West Virginia, where the coal seam is situated high in the mountain, a modern aërial wire-rope tramway is used to advantage. The tramway crosses a river and runs to a loading station near the top of the mountain; it has a clear span of 1300 ft. The buckets travel at the rate of 300 ft. per minute, and make the entire distance in about 4 minutes. The difference in elevation between loading and discharging stations is 360 ft., which permits the tramway to be operated by gravity. The speed is controlled by two brakes at the loading station. The tramway handles 800 tons a day and requires the services of two men at a total cost of $4 per day; this makes the cost of transporting coal over this system ½ cent per ton for labor. It is stated that the same labor could handle practically double the present tonnage by adding more buckets.

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Production of Lead in the United States

Reports from all of the smelters and refiners show that the production of refined lead in the United States in 1908 was 413,868 tons as compared to 426,146 tons in 1907. Details of the production are given in the subjoined table, which shows the production of Missouri and Kansas lead according to groups of smelters, the single smelter in Kansas being included in "Southwest Missouri," and the two smelters in Illinois, near St. Louis, in "Southeast Missouri." The lead that is entered as "desilverized" is the production of desilverizing refiners other than those included in the two groups above mentioned. The present conditions of lead smelting in the United States do not permit of any accurate, and at the same time rational, classification.

PRODUCTION OF REFINED LEAD.

Class.	1907	1908.
Desilverized	213,383	187,759
Antimonial	9,614	*a*
Southeast Missouri	108,510	113,103
Southwest Missouri	17,833	18,014
Miscellaneous	790	.....
Total domestic	350,130	318,876
Desilverized, foreign	76,016	94,992
Grand total	426,146	413,868

(*a*) The production of antimonial lead in 1908 was 13,109 tons; in the above table it is included with the lead entered as desilverized.

The above statistics include a considerable quantity of lead refined from scrap and old metal, which is reworked by several of the refiners whose principal business is the refining of base bullion of virgin origin. There is, moreover, a considerable production of lead by smelters who make a business of reworking old metal only. To some extent they market their product as pig lead, and to some extent they refine it as an alloy, which is marketed. It is difficult to draw the line where statistical enumeration should cease in this respect. In 1907 the production of such reclaimed pig lead was 9990 tons, while the production in the form of alloys was 15,508 tons. In 1908 the production of pig lead from old material was 14,323 tons. It is probable that the reports of this industry are incomplete both for 1907 and 1908.

The statistics of lead of foreign origin as reported by the refiners do not agree exactly with the reports of imports by the Bureau of Statistics of the Department of Commerce and Labor, which in 1907 entered the importation of lead in ore and base bullion as 70,537 tons; and in 1908 as 109,286 tons. The discrepancy in 1907 is partly accounted for by the item of antimonial lead, which is recorded in the above table as wholly of domestic origin, whereas a large part of it was doubtless of foreign origin. However, discrepancies are explained anyway by metal in transit, process of refining, and accumulated stocks.

The distribution of the domestic production of virgin lead is given as nearly as possible in the second table. The total for this table does not agree with that of the first table because (1) lead derived from scrap is excluded, and (2) the figures in this table are based to a large extent upon the reports of the producers of work lead, which obviously show the origin of the metal much better than the reports of the refiners can do. Differences between the reports of smelters and refiners are, of course, explained by metal in transit, treatment, etc.

PRODUCTION OF LEAD BY STATES.

State.	1907.	1908.
Arizona	2,200	1,867
California	850	490
Colorado	47,332	26,707
Idaho	111,697	98,394
Kansas	1,800	2,400
Missouri	123,613	125,216
Montana	2,005	2,309
Nevada	3,400	3,676
New Mexico	1,900	611
Oklahoma	400	1,000
Utah	54,738	43,995
Wisconsin	3,500	3,486
Other States	1,204	600
Undistributed	.....	2,026
Zinc smelters	1,320	1,290
Total	355,959	314,067

The striking features of the statistics for 1908 are the further gain of Missouri as the premier lead-producing State and the decline in the production of nearly all of the other important lead-producing States, especially Colorado. It is probable that a large part of the lead that we have entered as "undistributed" (because we could not be sure of its source) belongs really to Colorado. The item entered under the caption of "Zinc Smelters" represents lead obtained from their residues, the origin of which it is next to impossible to trace.

Gold Production of Russia

The receipts of gold, reported in terms of the fine metal, at the government and private laboratories in 1908, were 1,279,805 oz. troy, compared to 1,166,032 oz. troy in 1907. Increasing these figures by 10 per cent. in each case, in accordance with our usual custom, in order to allow for gold clandestinely exported, or otherwise escaping official record, we estimate that the gold production of Russia in 1908

was 1,407,770 oz., compared to 1,282,635 in 1907. The increase was not altogether expected in view of the unfavorable conditions from which gold mining in Russia has been suffering, these having been the subject of general complaint. The major part of the increase in 1908 was due to the Rodaibi district in the Irkutsk Government, and the Yakutsk district, which comprise the most productive region of the Empire at present, this contributing about one-third of the total output. The Lena Gold Mining Company alone produced 273,865 oz. of fine gold in 1908, this being the most productive single undertaking in Russia. Indeed it must be in the first rank of the gold producers of the world. The Waihi mine of New Zealand in 1908 produced $4,495,847.

The Virginian Railway

An event of much importance to the West Virginia coalfields occurred this week in the formal opening for traffic of the Virginia Railway, which has been under construction for nearly three years past. This road begins at Deepwater on the Chesapeake & Ohio, extends southeasterly for some distance and then eastward, passing through Norfolk and reaching tidewater at Sewell's Point on Hampton Roads. It was planned and built as a coal road chiefly, other traffic being merely incidental, and great pains were taken in its location to secure favorable grades for the eastbound traffic which will constitute the bulk of its business. In its construction some expensive work was required to overcome the grades where it leaves the Kanawha valley and at some other points where it crosses the mountain ridges running northeast and southwest. For a considerable part of the distance traversed it parallels the Norfolk & Western railroad and it will be a competitor of that road to a certain extent for coal traffic, although it will not interfere at all with the through southwestern business, or indeed with the local trade of that line. The total length of the road from Sewell's Point to Deepwater is 436 miles and some short branches bring the total up to 450 miles of railroad. The total cost is said to have been about $40,000,000, including the extensive tidewater terminals.

The road will not be altogether a competitor of existing lines but will have, even at the start, some new trade of its own. It will interfere very little with the Chesapeake & Ohio and will leave to the Norfolk & Western practically all the trade of the Pocahontas and Tug River fields. It will open up a comparatively new district in West Virginia lying between the two older roads; in this district several large mines have already been developed or are being developed.

An unusual feature of this road is that it has been built and is owned practically by one man, H. H. Rogers of the Standard Oil Company. His purpose in building the road, it is understood, was his belief that it would be a profitable investment of capital and it is expected that he will retain its control in his own hands. At any rate no arrangements have been made to distribute its securities to the public. We can recall no other case of a railroad built in this way since Asa Packer built the original Lehigh Valley railroad—the nucleus of the present Lehigh Valley system—practically single-handed in the early fifties. That was a sufficiently large undertaking for one man in its day, but was far short of the achievement of Mr. Rogers in building the Virginian railway.

Copper Production of the World

The annual statistics of Henry R. Merton & Co., Ltd., of London, received this week, show that according to its reports the world's production of copper in 1908 was 748,625 long tons, compared to 713,865 in 1907. The figures for the principal countries are given in the following table:

	1907.	1908.
Australasia	41,250	39,500
Canada	25,615	28,570
Chile	26,685	38,315
Germany	20,490	20,200
Japan	48,935	43,000
Mexico	56,565	37,570
Peru	10,575	15,000
Russia	15,000	20,085
Spain and Portugal	49,675	52,585
United States	392,520	425,175

We have previously commented upon the statistics for the United States, Canada and Mexico. As to the statistics for the remainder of the world, the most noteworthy features for 1908 are the large increases in the production of Russia, Chile and Peru. The increase in Russia was due largely to the operations of some of the new British concerns, such as the Spassky Copper Company; the increase in Peru was due chiefly to the Cerro de Pasco company, which now appears to be getting its gait. The increase in the production of Chile is particularly interesting. Many years ago this country ranked among the most important copper producers of the world, but for nearly 20 years its output has been practically at a standstill. American and British companies are now becoming more extensively interested in the resources of that country, and their work is evidently reflected in the statistics for 1908, which show the largest production of copper in Chile since 1890. The statistics of Merton & Co. omit the production of Cuba, which amounted to 2966 metric tons in 1908, against 1388 in 1907.

A High Grade Copper Mine

It has become so much a custom to talk about copper mines that yield 1 to 2 per cent. of the metal, or translating the percentage into pounds per ton to sound better, that it is rather startling to find a copper mine producing on a large scale ore that assays about 30 per cent. copper. That is what the Poderosa Mining Company obtains at Collahuasi, Chile. This mine is also of interest by virtue of its being under the management of Robert Hawxhurst, an engineer well known in the United States. His company produces about 2000 tons of ore per month that assays about 30 per cent. copper, besides some "low-grade" ore that goes 11 per cent. copper and some "waste" that goes 4 to 5 per cent. In the six months ending June 30, 1908, the production of high-grade ore was 13,795 tons. At the beginning of that year the ore reserves were estimated at 100,000 tons, which amount was fully maintained by the developments of the semester. The production of copper in Chile in 1908 having been about 38,000 tons, it will be seen that the output of the Poderosa mines forms a respectable percentage of the total. The vein from which this ore is mined apears to be from 10 to 40 in. in width.

No strike nor lockout has taken place in the anthracite region, both sides agreeing that work shall continue under the existing agreement, at least until another conference can be held. That conference begins today (April 7), but will continue probably for two or three days. Reports, which seem well founded, are to the effect that the miners' committee will give way, insisting only upon some small points for form's sake. The position of the operators is too strong to make a contest at all hopeful just now.

North Dakota Coal Lands

The first indication of the new policy that is to govern the Land Office under President Taft and Secretary of the Interior Ballinger was afforded on March 29, when by recommendation of the secretary, President Taft revoked an executive order issued by President Roosevelt in 1906, under which 1,866,000 acres of land in North Dakota were withdrawn from entry. This land was withdrawn in consequence of a report that it contained lignite coal, and that a combination of interests were trying to get a monopoly of the supply. The restoration of these lands now permits entries to be made under the general land laws applicable to that area. A statement issued by Secretary Ballinger on this topic says that if the lands are agricultural in character they may be entered under the homestead laws; if valuable because of workable deposits of coal they may be entered under the coal-land laws. This action will relieve from suspension and pass to patent a large number of homestead entries which had been suspended for field examination because of the existing withdrawal. President Roosevelt was understood to have withdrawn this land from entry in pursuance of his conservation policy. The new President's policy, according to the statements of officials in touch with this branch of the Government's operations, is "development of natural resources." The land laws were amended at the last session of Congress so as to permit homestead entries to be made on land "chiefly valuable" for agriculture. The old law would not permit such entries, even if the mineral deposits were nearly worthless.

The Bureau of Mines Bill

Senator Dick, of Ohio, chairman of the Senate Committee on Mines and Mining, has reintroduced the Bureau of Mines bill with some minor changes and intends to press it during the present Congress, though—in view of the decision (April 1) to bar legislation other than the tariff and the census—he will not be able to act at the current session. In the form in which it has now been introduced by Senator Dick, the bill provides for the establishment of a Bureau of Mines in the Department of the Interior, which is to make such investigations as may develop greater safety and efficiency in mining, extracting and utilizing the mineral substances of the United States and the investigation of materials of construction, fuels, and other mineral materials belonging to or for the use of the Government of the United States with a view to their more efficient use. The bill follows the measure of last session in authorizing the Secretary of the Interior to transfer to the new bureau from the Geological Survey, the work of supervising the investigations of structural materials, the analyzing and testing of coals, lignites and other fuels, the investigation of the causes of mine explosions, and the inquiries into plans for the protection of the lives of miners. This work is, however, limited to the Territories of the United States, thus doing away with the objection raised against the old bill that it would give a bureau of mines power to make regulations which might interfere with the regulations of the States in regard to the same or allied subjects.

The bill further contains the following provision: "That no examinations shall be made for private parties or corporations except with the approval of the Secretary of the Interior and under such regulations as he may prescribe where such examinations involve the question of public safety, prospecting on public lands, or a serious waste of mineral resources; and in all such cases the cost of the examinations shall be charged against parties for whom the examinations are made, and the money so received shall be paid into the Treasury of the United States."

The Rio Tinto Company in 1908

The Rio Tinto Company in 1908 extracted 604,275 tons of pyrites for shipment and 1,115,610 for local treatment, a total of 1,719,885 tons. The quantity of cupreous ore invoiced to consumers in 1908 was 589,815 tons against 607,944 tons in 1907, and 632,307 tons in 1906. Of the deliveries in 1908 Germany took 300,361 tons, the United Kingdom 118,156 tons, and the United States 171,298 tons. The deliveries of sulphur ore, which were 477,843 tons in 1906, and 619,814 tons in 1907, were 688,477 tons in 1908. The copper produced in 1908 by treatment at the mines amounted to 24,256 tons, and the fine copper in pyrites shipped was 9958 tons, a total of 34,214 tons. The following quantities were marketed: Refined and blister copper, 25,093 tons; copper in pyrites, 9821 tons; total, 34,914 tons. The profit on the sale of products in 1908 was £1,446,504.

Satisfactory progress has been made with the opencasting of the San Dionisio Lode. Two of the tunnels, through which the overburden will be removed, are now complete, and progress has been made with the third or lowest outlet. The extension of the South Lode Opencast is proceeding well, and will effect a more economical extraction of the mineral in the near future. The output of mineral for 1908 was considerably reduced through the subsidences mentioned last year, but no further slips have occurred.

March Dividends

The accompanying table shows the total amount, and the amount per share, of the dividends paid during the month of March, 1909, by mining and industrial companies in the United States, and by some foreign mining companies:

U. S. Mining Companies.	Location.	Amt. per Share.	Amt. Paid.
Am. Smelters, pf., A.	U. S.	1.50	255,000
Am. Smelters, pf., B.	U. S.	1.25	375,000
Bunker Hill & Sull.	Ida.	0.20	60,000
Calumet & Arizona.	Ariz.	1.00	20,000
Calumet & Hecla.	Mich.	5.00	500,000
Colorado	Utah	0.08	80,000
Doe Run Lead	Mo.	1.50	94,888
Fed. M. & S. Co., pf.	Ida.	1.75	210,000
Homestake	S. D.	0.50	109,200
MacNamara	New	0.01	7,300
North Butte	Mont.	1.00	400,000
North Star	Cal.	0.30	75,000
Old Dominion, M.	Ariz.	0.50	146,622
Old Dom. M. & S.	Ariz.	1.00	162,000
Phelps, Dodge & Co.		0.02½	1,123,365
Quincy	Mich.	1.00	150,000
Round Mt. M. Co.	Nev.	0.04	31,933
Utah Copper	Utah	0.50	365,000
United Verde	Ariz.	0.75	225,000

U. S. Industrials.	Location.	Amt. per Share.	Amt. Paid.
American Coal	Md.	$1.25	62,500
Crucible Steel, pf.	Penn.	1.00	244,365
Genr'l Chem., com.	U. S.	1.00	74,103
Nat. Lead, pf.	U. S.	1.75	260,820
Sloss Sheffield	Ala.	1.25	125,000
Standard Oil	U. S.	15.00	14,550,000
U. S. Steel, com	U. S.	0.50	2,541,512
U. S. Steel, pf	U. S.	1.75	6,304,918

Foreign Mining Companies.	Location.	Amt. per Share.	Amt. Paid.
Crown Reserve	Ont.	$0.15	$262,500
Esperanza	Mex.	0.37	168,350
Kerr Lake	Ont.	0.20	120,000
Le Roi 2	B. C.	0.48	57,600
Mines Co. of Am.	Mex.	0.02	40,000
Perigrina M. & M.	Mex.	3.50	350,000

International Smelting and Refining Company

The organization of this company has been perfected by the election of John D. Ryan, as president, Dennis Sheedy, as vice-president, and John W. Allen as secretary and treasurer. The board of directors consists of these, together with U. H. Broughton, Charles F. Brooker, Thomas F. Cole, Adolph Lewisohn, E. C. Converse, Thomas Morrison, C. A. Congdon, Wm. D. Thornton and Charles F. King.

The new company has taken over the Raritan copper refinery, from the United Metals Selling Company, as of Jan. 1, 1909. The new Tooele smeltery is under construction. The company is also considering the purchase of the Tintic smeltery in Utah and the Torreon smeltery in Mexico.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Electrically Driven Mine Pumps

To the interesting article by Sydney F. Walker in the JOURNAL of Feb. 20, 1909, may be added the experience of pumping by electricity in Aspen, Colo., where electrically driven mining machinery originated.

In Aspen all sorts of pumps have been used for mine pumping, from the old Cornish pump to the uptodate, highly polished and attuned electric pump. Some of the electric pumps have necessarily been freaks, on account of local conditions, and perhaps also attributable to the evolution of that class of mine machinery.

Several years ago one of the freak installations was an ordinary three-throw plunger pump driven by continuous-current shunt motor and placed at the collar of a shaft in a tunnel. It was to pump water from the bottom of the shaft 80 ft. to an ejector which in turn ejected the water, with the additional mine water, up to the tunnel or level of pump. This pump and ejector did the unwatering in sinking the shaft and carrying on continuous stoping.

Another freak, also an ordinary three-throw 7-in. plunger pump was placed in the bottom of a 220-ft. shaft as a station pump and was driven by ½-in. wire-rope transmission from the 20-h.p., continuous-current, shunt motor placed at the collar of the shaft. This pump was once, during a flood, submerged under 65 ft. of water, and kept on running for two days until the mine was drained. During that time the 20-h.p. motor developed 37 h.p. intermittently and at one time continuously for eight hours without injury, the increase of power being due to obstruction of the water to the transmission gearing.

The last electrically driven pump installed is a 7x12-in., five-throw, horizontal plunger pump driven by a 90-h.p., variable-speed, continuous-current, shunt motor, working under a head of 500 ft. at a variable speed of 45 to 60 revolutions, delivering the water in the same variable ratio, 450 to 600 gal. per min., at a combined efficiency of 87 per cent. The variation of flow of water is due to the damming up and emptying of water courses and to spring thaws, and at times the water is very muddy.

This pump has been running continuously for 18 months, not losing the water once, except for 20 min. at a time for each plunger every three months when renewing packing, at which times the water is stored in an excavated sump under the pump. The cost of running the pump averages $500 per month for 500 gal. per min. against a 500-ft. lift.

This form of pump takes the water from a state of rest and delivers it to the discharge column in a continuous stream, thus only limiting the speed by the strength of pump chamber, making a possible flexibility as to capacity of several hundred per cent., and consequently rendering it an ideal mining pump.

CHARLES E. ANDERSON.

Aspen, Colo., March 15, 1909.

The Nature of High Explosives

In the JOURNAL of Feb. 6, 1909, I find under the heading "Colliery Notes" the following paragraph:

"A nitroglycerin explosive is less sensitive with a small-diameter cartridge, but an ammonium nitrate explosive is more sensitive with a small-diameter cartridge."

I wish to take exception to this paragraph, as the statement made does not conform to our understanding of the nature of high explosives. It is a well known fact that detonation "carries" better in larger cartridges of all explosives, whether they be nitroglycerin dynamite, ammonia dynamite, ammonium nitrate compounds, gelatin dynamite or blasting gelatin, than in smaller cartridges. This does not apply to the actual sensitiveness, except that in long charges, a stronger detonator is required in those of small diameter on account of the resistance offered by the charge of small diameter to the detonation wave. In a way this is similar to the friction of liquids flowing in a small pipe as compared with those flowing in pipes of large diameter. In regard to the statement concerning the ammonium nitrate explosives (through which the detonating wave does not carry so readily as through an ammonia dynamite), it has been definitely proved that these explosives cannot be used with success except when packed in cartridges of a diameter equal to or larger than 1¼ in. The only explosive of this class which has been successfully used in cartridges of as small a diameter as 1¼ in. is Monobel. This is the result of a great many careful and extended experiments made by the technical division of the Du Pont Company under all conditions of practical work.

F. H. GUNSOLUS.

Wilmington, Del., Feb. 15, 1909.

Developments in Gold Dredging in 1908

I note with interest the article on this subject, by John Power Hutchins, published in the JOURNAL of Jan. 23, 1909. I also note Mr. Hutchins' observations concerning wooden hulls and their defects and his mention of structural steel having been used in connection with the wooden hulls for the purpose of strengthening the same. I would call attention to a form of construction that I designed and incorporated in a dredge which has given excellent satisfaction during two years' use.

In this design all of the gantries were of structural steel work and were joined together by a structural steel truss. This construction formed a regular Howe truss running throughout the length of the dredge with the front and rear gantry at each end and the main gantry carrying the upper tumbler in the center, there being two of these trusses, one on each side of the well and joined throughout their length at various intervals.

The principal idea was to avoid composite construction; in other words, to avoid securing any one of the three gantries directly to the woodwork of the hull as it has been found almost impossible to secure steel work to the wooden structure in a satisfactory manner, the steel always cutting more or less into the woodwork when any strain was put upon it and thus becoming loose.

These three gantries being embodied in this steel truss-work made the whole structure a complete unit and the bottom chord of the steel truss simply rested on a sill or stringer running the entire length of the dredge, to which each of the floor beams was secured. This form of construction kept all the digging strains within the steel truss girder and at the same time this girder reinforced the hull so that there was no tendency of the hull to become distorted.

After two years successful operation of this dredge, careful observations have shown the hull and all the superstructure to be in perfect condition.

Further on in the article Mr. Hutchins speaks of steel hulls being more rigid and durable than those of wood and states that they should be used in tropical climates, but inasmuch as he states that no gold dredges with steel hulls have yet been built in the United States, one would naturally infer that this work had not been

taken up by anyone, whereas in the JOURNAL of Jan 23, 1909, it may be noted that the advertisement of the New York Engineering Company, on page 145, illustrates an all-steel dredge in which is embodied the structural steel truss girder construction for all the superstructure and gantries as described above, only this is built on the deck of a steel hull instead of resting on the floor of a wooden one.

I believe the day is near at hand for steel hulls in this country and excepting in one or two States where suitable pine is to be cut close at hand, this steel hull will not prove any more expensive than the wooden hull, and in most instances it would be cheaper on account of less labor involved in assembling the dredge.

The steel hull is readily assembled, requiring only pneumatic riveting and bolting in order to complete same, and the installation of the machinery is much more readily accomplished with the steel hull and superstructure as most all of this work is laid out and executed in the shop under favorable conditions and the assembling of the machinery on the hull in the field only requires bolting or riveting in place.

Mr. Hutchins also calls attention to the need of a small dredge for the exploitation of areas not suitable for a larger dredge. This need for a small dredge having been appreciated by me some time ago, I set about to design and build this all-steel form of dredge, advertised in the JOURNAL, especially in the smaller size having two cubic-foot buckets.

This form of construction results in a large saving in freight and transportation and labor in erecting. At the same time it provides a modern and efficient dredge at a very low cost and one that is especially designed for the exploitation of small and limited areas.

A. C. LUDLUM.

New York City, Jan. 29, 1909.

Lake Superior Iron Ore

I note in the statistics of "Lake Superior Iron Ore," in the JOURNAL of March 20, 1909, that ores from Mayville, Wis., mines are included with those from the Illinois mine of the Baraboo range. While it is advisable perhaps to include in some way the Mayville and Iron Ridge ores from Dodge county in Lake Superior statistics, yet from a geological point of view at least they should be kept separate from the ores of the Baraboo range.

The Baraboo ore is pre-Cambrian like that of the Lake Superior ranges. The Mayville and vicinity mines are in the Clinton iron-ore beds, like the Birmingham, Ala., ores. The Mayville mines have been worked for 60 years since 1849, the total production probably being between 2,000,000 and 3,000,000 tons, largely used in local furnaces. The Baraboo range has been worked since 1903.

SAMUEL WEIDMAN.

Madison, Wis., March 25, 1909.

Sharpening Drills Underground

SPECIAL CORRESPONDENCE

The topical discussions introduced into the proceedings of the South African Association of Engineers promise to be a successful feature of meetings in the future. The scheme—introduced at the last gathering—is simply to supplement the regular proceedings by the reading of brief notes on some pertinent question, for informal discussion by those present, as remarks and criticisms made cannot have received careful previous consideration, the discussion is not reported verbatim in the *Journal* of the Association, and the summarized version is submitted to speakers for correction. Members are thus encouraged to speak freely, and the truth of matters may be arrived at more speedily, if clumsily, owing to the absence of elaborate preparation of remarks, from which inadvisable, though serviceable, opinions are often omitted. At the last meeting of the association, Baron Mannerheim opened a discussion by reading notes on the advantages of sharpening drills underground—not by any particular method, though he is associated with the exploitation of an electric furnace. While the meeting was unanimously in favor of sharpening underground in deep-level mines, there was a wide divergence of opinion as to the means. W. Thomas, manager of the Jumpers Deep, reported the successful employment of Mowbray oil furnaces. These he has installed at several points in the mine so as to be near the working faces and reduce transportation of drills, where the vitiated air—apparently unimportant—can rise to old stopes or places where it cannot cause any deleterious effects.

The electricians claim that the great merit of the electric furnace is the infallible means it provides for maintaining exactly the critical temperature required to obtain the best results, from different classes of drill steel. It has been frequently urged that adequate attention is not paid to this side of the question in Rand routine practice, and that if the proper heat can be obtained by a scientific system, such as regulation in an electric furnace, the faults due to variation in coal or in oil furnaces, and to carelessness or ignorance on the part of the smith will be prevented. Working underground without centralization, which would largely neutralize the savings attributable to the scheme—the need of supervision must be greater, when furnace conditions are similar to those on surface. Mr. Thomas claims that he has used his oil furnaces underground on drill steel of all qualities and that, owing to the ease of gaging the temperature by experienced observation, there have been no complaints as to faulty tempering.

It is most probable that the whole question will be thrashed out thoroughly by some expert, able to devote his whole time to the subject, in due course, and if the informal topical discussion mentioned has influenced the movement, its practical utility will have been proved substantially. In the deep-level mines, upon which the number of shafts of over 2000 ft., vertical with independent inclines to serve the ground below, are yearly growing in number, there is not only the cost of hoisting to be considered, but also the time taken in loading and unloading the skips or cages with sharpened or blunt drills, numbering thousands per day. There is also to be considered the benefit of bringing the users of the drills—the machinemen or hand-labor supervisors—into closer contact with the sharpeners. But it is necessary to be sure that the standard of efficiency is maintained.

Metallic Chromium from Chromite

A German patent (No. 205,789) has been granted to E. Viel, of Rennes, France, for a process of extracting metallic chromium from ferro-chromes or from natural chromite. The process consists in treating the raw material, mixed with lime or clay and a calculated amount of carbon, at a high heat in an electric furnace. This forms double silicates of iron or alumina and calcium, together with such other metals as may be present, aside from the chromium. The heating must not be long continued, or the double silicates will be dissociated.

Supposing the raw material to be a ferro-chrome containing 60 to 68 per cent. chromium and 8 to 12 per cent. carbon, together with such impurities as manganese, magnesia and alumina. This is pulverized, mixed with sand and lime, or a silicate of lime, and heated for 5 min. at a temperature of at least 3500 deg. C. A double silicate of iron and calcium is formed and also one of calcium and manganese, etc., which float on the calcium carbide, which is also formed. The heavy chromium metal goes to the bottom of the furnace. The whole mass is then poured into a deep receptacle and allowed to cool, after which the several layers are broken apart.

If chromite is used for the raw material, only enough carbon is added to reduce a part of the chromic oxide, while the oxides of iron, manganese, etc., will not be reduced at all and thus enter into silicates with the lime and sand. The time and the temperature of the treatment are the same as with the ferro-chrome.

Tariff Legislation

SPECIAL CORRESPONDENCE

On April 3 the Committee on Ways and Means, after a long session, announced the amendments to the Payne bill on which they had been working for more than a week. While these amendments, as made public by the committee, numbered about 60, few of them were of general interest. The only ones affecting the metal and allied schedules appreciably were in charcoal-iron (paragraph 118), which was raised from $6 per ton to $10 per ton; in paragraph 88 where fluorspar, which had been 50c. per ton crude and $1.75 manufactured, was made dutiable at a uniform rate of $1.50 per ton; in paragraph 134 where wire over No. 16 gage was changed from 1¼c. per pound to 1¾c.; and in paragraph 89 where mica was made 10c. per pound plus 20 per cent. when manufactured; 5c. per pound and 20 per cent. when crude, instead of being taxable at 30 and 35 per cent. ad valorem, as in the original Payne bill. Copperas, which was on the free list, is made dutiable at 0.15c. per pound. Carbon electrodes were added to paragraph 93, and put at 10 per cent. ad valorem. In paragraph 182 the word "ferrophosphate" has been altered to "ferrophosphorus."

PATENT PROVISIONS

An important alteration in the bill was made by dropping out the section on providing for a retaliatory patent policy. The section was simply cut out without the insertion of any substitute. This result was arrived at in consequence, largely, of representations on the part of the State Department, which informed the committee that it had practically settled the terms of patent treaties with some of the more important European countries under which we should be relieved of the retaliatory working of the patent legislation of those countries particularly insofar as concerns the so-called "manufacturing clause." This and the urgent representations of some of the best known patent attorneys in the United States sufficed to bring about the elimination of the objectionable section. It also appeared that to adopt the section would violate important international agreements.

IRON AND STEEL

One of the tariff schedules that is receiving the closest attention from the Senate Finance committee is Schedule C, which deals with metals. The portions of this schedule which relate to iron and steel were taken up for formal investigation on March 27, at which time a large delegation of iron and steel manufacturers, headed by Judge E. H. Gary, of the Steel Corporation, and Willis L. King, of the Jones & Laughlin Steel Company, appeared before the committee. In general discussion the rates fixed in the Payne tariff bill were covered, and it was made plain that the steelmakers did not consider the schedule there established to be at all feasible. The chief criticisms made upon it were based upon the apparent bad adjustment of the rates to one another and the fact that, in many cases, products which should have been highly taxed with reference to others were set at a lower rate, while in other cases products which should have been placed on a lower basis were maintained at a high point. It is understood that the criticism of the Payne tariff followed substantially the lines that were pursued by Representative Underwood, of Alabama, in his speech before the House of Representatives in which he condemned the methods followed by the Ways and Means Committee in constructing the iron and steel schedule. Particular reference was made to the Payne tariff on scrap iron, and it was suggested that this should be made identical with the duty on pig or at least approximately equal to it, in order to prevent the introduction of broken pig under the head of scrap. Severe criticism of the treatment accorded to steel billets and rails was also afforded. While it was understood that the steel and iron representatives had been given a "hearing" in the usual sense of that term, Senator Aldrich has since denied, in a speech before the Senate, that such was the case. Mr. Aldrich refers to the incident as merely a consultation or "conversation" between the Republican members of the committee and some experts who were called in for consideration of the schedules.

IRON ORE

The treatment of iron ore in the Senate now seems likely to be radically different from that accorded to this item in the House. Reduction of the duty existing in the Dingley bill by about 20 per cent., making it 32c. per ton (instead of 40c.), with a further reduction of another 20 per cent. on Cuban ores coming in under the reciprocity treaty and thus reducing the rate to 25c. per ton is probable. This disposition of the ore question has been demanded by representatives of the minor ore-producing districts who believe that the introduction of free iron ore will be injurious to the business of their particular localities. There has been a strong desire on the part of the House leaders to adhere to the Payne treatment of iron ore, as in this way some semblance of the "free raw materials" policy could be maintained. It is unlikely that the House will at the last hold out against the Senate should the latter body restore one-half or two-thirds of the original duties on iron ore. Only as a result of extreme pressure and in view of the desire to make some show of introducing a liberal tariff bill while at the same time satisfying most of the manufacturing interests did the Ways and Means Committee remove the Dingley tariff on ore, and there are several members of the committee who would welcome a chance to replace a tariff on this item in the list. The leaders have also felt quite keenly criticisms based upon the differences between their method of dealing with iron and lead and zinc ores.

COAL

Discussion of the tariff bill has developed some sharp differences of view with respect to the duty on coal. The Payne tariff provides for reciprocity in coal with Canada on a free-trade basis, and during the past week this has called forth strong protests from Western mining interests, as well as from those of Virginia and West Virginia. It has been the claim of these sections of the country that the effect of the new provision, if carried out by a mutual agreement with Canada, would be to deprive the domestic producer of a market for about 6,000,000 tons of coal in New England and to turn this market over to the Canadian producer. That the removal of the tariff of 67c. per ton on Canadian coal would not make a difference in ordinary retail prices exceeding 10c. per ton has been asserted on the floor by Representative F. W. Mondell, of Wyoming, chairman of the House Committee on Public Lands, in a set speech. It has been demanded by the coal interests that the tariff be restored at the rate of at least 45c. per ton, while they have also asked that the more favorable tariff treatment accorded to slack coal and culm in the bill be continued. Under the Dingley act, these forms of coal were dutiable at 15 per cent., but the Payne bill places them on an equality with other grades of coal. Were the duty to be restored at a flat rate of 45c. with no reciprocity provision, the new treatment of slack and culm continued, the domestic producer would consider himself in a much better position. The demand for this tariff program as regards coal has been made by Senator Elkins, of West Virginia, in conference with Senator Aldrich, of the Senate Committee on Finance.

DUTY ON LEAD

In a speech before the House on April 3 Representative Howwell, of Utah, attacked the duties on lead carried by the Payne bill and submitted a lengthy memorial from the Conference of Lead Ore Producers of Colorado, Utah, Idaho and Nevada, addressed to the Senate and House, in which they requested that the bill be improved by the addition of such a differential duty on pig lead and refined lead "as will preserve the industry." The Ore Producers Conference urges that the proposed reductions would open the market to Mexican lead, to the detriment of our own industry.

Questions and Answers

Inquiries for information are answered in this department as promptly as possible, but more or less delay is often unavoidable. Many inquiries involve a good deal of investigation and these can be answered only when the general interest in the subject is conceived to justify the expenditure of the time required. Correspondents should refrain from asking for advice that ought to be obtained by professional consultation with an engineer. We will not answer questions pertaining to the value of specific mining enterprises. Inquiries should be framed concisely.

Chemical Engineer

Will the Journal please give its definition of a "chemical engineer?"

W. M.

A chemical engineer is one who has a fundamental knowledge of chemistry, and is sufficiently familiar with the principles of mechanical engineering to enable him to deal with problems of construction, operation and maintenance in connection with manufacturing processes including chemical principles.

Infusorial Earth

What is infusorial earth worth? Who deals in this material?

T. H. W.

Infusorial earth, best American ground, is quoted at 1¾c. per lb.; best German ground, 2½ to 2⅝c. per lb., f.o.b. New York. The following are dealers in infusorial earth: W. H. Whittaker, 245 Front street, New York; Hammill & Gillespie, 240 Front street, New York; T. Van Amringe, 241 Water street, New York.

Monazite Sand

What is the price of monazite sand? Is any of this material imported?

S. M. O.

The United States imports practically no monazite or other thorium-bearing minerals. About 25 tons of thorium nitrate are imported yearly. The average price for 1907 was 12c. per lb. for 90 per cent. monazite sand. The present quotations are 8c. per lb. and upward, according to quality. Prices are published in the Journal, in the chemical table which appears in the first issue of each month. The quotations given are the prices asked of the consumer by the dealer.

Monzonite

What is monzonite? Although I find this rock referred to frequently in geological literature and know that it is a variety of what miners commonly call porphyry, I have been unable to obtain a precise definition. P. T. A.

Monzonites are rocks occupying an intermediate position between the syenites and the diorites, i.e., rocks in which plagioclase plays a greater rôle than in the syenites but not so great as in the diorites. Lindgren has proposed that rocks having alkali feldspar to the extent of more than two-thirds of the total feldspar be classed with the syenites and with less than one-third with the diorites, classifying the intermediate rocks as monzonites. This proposal has found adoption.

The Hydraulic Mining Cartridge

In the Journal of Dec. 19, 1908, I notice on page 1211, under the head of "Colliery Notes," a paragraph concerning the hydraulic mining cartridge, which is being used successfully in England, Scotland and Wales. I will be much obliged if you will give me the name of the manufacturer of this cartridge, or refer me to some party who can do so.

E. L. C.

The mining cartridge concerning which you inquire is manufactured by the Hydraulic Mining Cartridge Company, 21 Mawdsley street, Bolton, England. A full description of this cartridge was published in *The Engineering and Mining Journal*, July 14, 1906. The cartridge has been successfully introduced in Canadian coal mines, but has not been introduced to any extent in the United States.

Effect of Atmospheric Pressure on the Frenier Spiral Pump

What effect, bad or otherwise, does atmospheric pressure have on a spiral pump (Frenier's patent), and why should atmospheric pressure affect this pump? There is no vacuum formed.

T. N. W.

At each revolution of the wheel of the Frenier pump, more than half of the outside spiral coil is filled with air. This air becomes more or less intimately mixed with the sand and water which are forced up into the discharge pipe, and is compressed therein. At a high altitude, the volume of air taken in is the same as at a lower altitude, but it suffers a greater compression, and the air spaces in the discharge pipe being thus reduced, a heavier column must necessarily be lifted. The lifting power of this pump has been shown to be less by 4 in. for every increase of 1000 ft. above sea level.

Proper Size of Headframe

I wish to erect a headframe to hoist a load of 6 tons. What is the proper hight, and what dimensions should I use for front legs and backstays?

T. W.

For such information, a competent engineer should be consulted. Many factors, such as speed of hoisting, character of materials, position of backstay, etc., enter into such a consideration which, in themselves, determine the amount of the stresses. However, for an approximation the formula given below will give figures which will be amply safe even though not as economical as if the size of members was determined by a graphical or analytical study of the stresses involved:

$$S = \sqrt[3]{\frac{W H^2}{8}},$$

in which

S = Side of square section of front legs in inches;

W = Working load, on hoisting cable, in tons;

H = Hight of frame, from ground to axis of sheaves, in feet;

Backstays = 5/9 section of front legs, of rectangular section in proportion of 3 to 4.

Coal Briquetting in the United States

What is the present status of coal briquetting in the United States? I am particularly interested to learn what success has been achieved by those who have attempted to briquet Western lignite coals.

E. S. M.

This industry at the present time may be considered as in its infancy. At various times elaborate plans have been completed for the erection of modern briquetting plants, only to be later held up by the parties interested because of the great uncertainty that surrounds the successful outcome of the venture. There are waterfalls in our country that are capable of developing thousands of horsepower annually, but are so located near large coal mines where fuel is cheap, that the work of harnessing these great natural agents would at present prove unprofitable. A waterfall at Goldfield, Nev., where coal sells for $15 a ton would prove a bonanza, while the same source of power could not be profitably utilized at Pittsburg, where coal can be purchased for $1.20 a ton. The same line of reasoning is applicable to the briquet industry. Experiments are now being made in the anthracite field, where the fine coal, that is not of great commercial value, is being made into briquets. It is too early to say whether the promoters of the industry in Pennsylvania will meet with success. The briquet industry has reached its greatest state of perfection in Germany, where a large percentage of the brown-coal production is made into briquets. The principal reason for the success of the industry on the continent is due to the fact that the brown coal will not stand transportation in its raw state, and can only reach the market after it has been made transportable by briquetting. There is no question but that the briquet industry in the United States stands the greatest chance of being successfully carried on in our Western States, where good fuel is scarce and where low grades of coal or lignite that cannot be satisfactorily transported are plentiful. The question of securing a suitable binder at a reasonable cost is also a consideration of much importance. One of our greatest transcontinental railroads has attempted to engage in the briquet industry in our Northwestern country, and the success of this venture will be watched with interest. Further information can be obtained by writing to the Renfrow Briquet Machine Company, St. Louis, Missouri.

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

S. W. Mudd, of Los Angeles, Cal., is visiting in New York.

C. N. Nelson is engaged in a prolonged examination of a mining property near Tucson, Arizona.

R. Britton Gottsberger has resigned his position as general manager of the Tennessee Copper Company.

Selwyn G. Blaylock, superintendent of the St. Eugene mine, East Kootenay, B. C., is back from a trip to the province of Quebec.

W. H. Aldridge, managing director of the Consolidated Mining and Smelting Company, of Canada, Ltd., was in Montreal recently.

Bruce R. Warden has returned from England to Nicola, B. C., and resumed his duties as engineer to the Nicola Valley Coal and Coke Company.

C. H. Benedict, chemist of the Calumet & Hecla stamp mills, is in the East, where he will deliver a series of lectures on the Lake Superior copper district.

R. E. Harris, president of the Nova Scotia Steel and Coal Company, has sailed for Europe in connection with the financial reorganization of the company.

H. S. Kerr, who has charge of the railroad and transportation interests of the Cerro de Pasco Mining Company in Peru, is visiting the United States on a leave of absence.

Gilbert S. Jones, district superintendent of the Temple Coal and Iron Company, at Pittston, Penn., has been suspended in consequence of the recent accident at the Mount Lookout colliery.

W. C. Seddon, of Baltimore, recently chosen chairman of the board of the Alabama Consolidated Coal and Iron Company, has been visiting the company's property in Birmingham, Ala., and vicinity.

G. A. McCarthy has resigned his position as chief engineer of the Temiskaming & Northern Ontario Railway to become superintendent of construction of a new power company, which will furnish electric power to the Cobalt mines.

Dr. B. Katsura, professor in the Technical College of the Imperial University at Tokyo, Japan, has been a visitor in New York. He will spend about five months in visiting mines and works in the United States, returning home by way of Vancouver.

C. W. Purington passed through New York last week on his way from London to Siberia. He will sail from San Francisco on May 13. He goes to undertake the management of the Kolchau placer property, near the mouth of the Amur river, for the Orsk Goldfields, Limited.

W. B. Devereux, Sr., and W. G. Devereux, of the firm of W. B. Devereux & Sons, New York, have been at Rhyolite, Nev., inspecting the Pioneer lease, in which they are interested. They are now on the way to Melones, Cal., to make an examination of the Melones mine.

W. J. Olcott, of Duluth, Minn., has been elected president of the Oliver Iron Mining Company, in place of Thomas F. Cole, resigned. This promotion was generally expected. Pentecost E. Mitchell succeeds Mr. Olcott as vice-president of the company. J. H. McLean, recently assistant to Mr. Mitchell, succeeds him as general manager.

Obituary

William Frank Hall died at his residence, Brooklyn, N. Y., March 4. He was well known and highly esteemed. For some time he had been connected with the Lehigh Car, Wheel and Axle Works, of Catasauqua, Penn., as New York representative.

Neil Black, well known in the Yale-Cariboo district of British Columbia as one of the pioneers of the famous gold rush to the Fraser river 50 years ago, was recently found dead near Spuzzum, in the cañon of the Fraser, where he had for years lived a lonely life in a small cabin. The very difficult work he accomplished many years ago as foreman of construction of the wagon road the government built through the Fraser cañon and thence to Cariboo was long a cause of much wonder to engineers and others.

Jacob H. Neff, one of the best known mining men of California, died in San Francisco, March 26. He was the first president of the California Miners' Association, an office he filled for six consecutive years. He was one of the organizers of that association, having presided at the meeting in Auburn, Placer county, where it was first proposed to make an attempt to rehabilitate hydraulic mining in California, and to form an association of miners for that purpose. Mr. Neff was a pioneer of the State and had mined in many portions of it, mainly in Placer county. He was one of the owners of the Morning Star drift mine on the Iowa Hill Divide, which paid dividends for many years, and was interested in other mining properties also. Mr. Neff was widely known among the miners of the whole State, and was highly respected by them all.

Jasper R. Rand, vice-president and director of the Ingersoll-Rand Company, died of pneumonia in Salt Lake City, March 30. Mr. Rand was the son of Jasper Raymond Rand, one of the founders of the Rand Drill Company, and was born in Montclair, N. J., in 1874. He was graduated from Cornell University in 1898 with the degree of mechanical engineer, and served in Porto Rico in the Spanish-American war as a member of the New York Volunteer Engineers. During 1899-1900 he was president of the Imperial Engine Company, at Painted Post, New York, leaving that position to take the presidency of the Rand Drill Company, which he held until 1905. In that year he was elected vice-president and director of the Ingersoll-Rand Company, which was his chief interest until the last. Mr. Rand was a member of the Spanish War Veterans, of the American Institute of Mining Engineers, of the American Society of Mechanical Engineers, of the Engineers' Club, of the Cornell Club, and of the Alpha Delta Phi Club, of New York. He is survived by one sister, Mrs. Henry Lang.

Capt. William Moore, one of the oldest sea captains on the north Pacific, died in Victoria, B. C., March 28. He was known as the founder of Skagway, the Alaskan port through which passes practically the whole trade of the Canadian Yukon and adjacent parts of Alaska. In the early nineties Mr. Moore, who had prospected the territory now known as the Yukon, repeatedly urged the Dominion government to build roads and trials, so that prospectors might be able to get about the country, and he was tireless in predicting discoveries of valuable goldfields. In full confidence that such would occur he occupied the site of what is now Skagway, and on the discovery of gold in the Yukon in large quantities, was instrumental in having the first large wharf built. All through the period of the big stampede into the Klondike he was a leading and most active resident of the "Gateway" town. Four years ago, his health having failed, he disposed of practically all his business interests, and removed to Victoria, where he remained until his death. He frequently expressed his belief that in remote sections of the northern country, of which he had knowledge, much gold would yet be found.

Societies and Technical Schools

University of Colorado—The members of the upper classes of the College of Engineering have been visiting mines, plants and works at Pueblo, Portland, Shoshone, Glenwood Springs, Leadville and Colorado Springs, on the annual inspection trip of the College.

Nova Scotia Mining Society—The officers elected at the recent annual meeting are: President, T. J. Brown; first vice-president, Prof. F. H. Sexton; second vice-president, G. J. Partington; secretary, A. A. Hayward; treasurer, H. M. Wylde; council, R. Drummond, B. F. Pearson, G. W. Stuart, C. E. Starr, J. R. Cowan, A. Dick, R. H. Brown, Thos. Cantley, A. L. McCallum.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Salt Lake City, Denver, Mexico City and Paris

REVIEWS OF IMPORTANT EVENTS

San Francisco

April 2—The principal topic of discussion among the mining men continues to be the probable effects of the new eight-hour law for men working in deep mines and around reduction works, quartz mills, etc. Some of the mineowners think it will affect mining more than the milling, and others think the other way. In most mills the men work either 10 or 12 hours, and complying with the law of eight hours materially increases costs. One of the largest gold mines of the State in point of production is worked on the 10-hour system and the owners think the new law will increase costs of mining and milling ore from 25 to 30 per cent. Another of the large mines will quit mining its low-grade ore, hang up most of its stamps, and mine only the better grade ore and run 10 stamps to crush it. Numbers of small mines, milling their own ore, will perforce close down entirely, being unable to continue when they have to have three shifts instead of two in both mine and mill. This law applies to the quicksilver and other "underground" mines of the State as well as to gold mines. At those properties, while some skilled miners are employed, considerable unskilled labor is used in mines and about the furnaces. The principal quicksilver mine of the State is working ore containing 0.15 per cent. quicksilver and increase of expense will work a hardship. The quicksilver industry of California is in a bad way in any case, as the demand for the metal is less than the production and this additional expense will undoubtedly close down the smaller properties.

Over in Nevada where a similar law has lately gone into effect the big productive properties can stand the change, but those companies in the development stage will find it a hardship. The gypsum men are already complaining in Nevada and declare that they must close their plants on the enforcement of the law. These laws provide for the regulation of miners in the gypsum mines and plants and require that only eight hours' work must be done.

The entire equipment of the electric-power plant of the Bonanza King Mining Company, on the East Fork of the Trinity river, Trinity county, was destroyed by fire this week. The plant was only two years old and was a very fine one, costing some $70,000. It was in fact much too big for the mine and mill. These will now have to close down. Several hundred thousand dollars were spent on this mine and a 40-stamp mill put up. James Treadwell, the principal owner, was financially ruined in the failure of the California Safe Deposit Company, and 20 stamps of the mill were sold. The mine has lately been worked on a small scale, though it had one of the finest equipments of any gold mine in the State.

The Trinity River Mining Company has finished its tunnel through the point of land near Lewiston, Trinity county, and will turn the river through it when the water lowers. By diverting the stream about two miles of river bed at the horse-shoe bend will be laid bare for mining. The tunnel will carry all the water of the river at the ordinary summer stage.

The Shasta Power Company and the Northern Light and Power Company have consolidated under the name of the Sacramento Valley Power Company. The Shasta Power Company has its plant on Snow creek, 28 miles east of Redding, Shasta county, and the Northern Light and Power Company has its plant on Cow creek in the same county. The merger means a branching out and extension of the power lines.

Salt Lake City

April 2—Sixty per cent. of the stock of the Pioneer Ore Sampling Company at Sandy has been sold to Ernest R. Woolley and associates. The price involved was not made public, but it is announced that no change will be made in the business management of the company, Frank Higginbotham remaining in charge of the business and L. A. Copeland continuing as superintendent at the works. The mill is situated 12 miles south of Salt Lake City between the tracks of the Rio Grande and the Salt Lake, Los Angeles & San Pedro railroads. The plant enjoys common-point rates from all directions and its location greatly favors the shippers from the Alta and American Fork districts with an even break on the ores from Big Cottonwood cañon. Mr. Woolley's "associates" are not announced.

The Boston Consolidated has announced a new issue of stock. It is understood that the receipts from the new stock will be applied to pay the floating debt and to provide for the cost of new work at the mines. It is stated that the management expects to run the mill at full capacity of 3000 tons per day after sufficient stripping has been done to provide the mill with ore of which at least one-half is mined by the steam-shovel method.

In connection with the consolidation of the Tetro and Plutus companies, stockholders of the Tetro who do not desire to receive in exchange shares of the Plutus Mining Company may accept a dividend of eight cents per share for all stock turned in. The property of the Tetro company was sold for $24,000, which amounts to approximately eight cents per share.

The Utah Fuel Company pleaded guilty in the United States Court to the charge of criminal conspiracy to unlawfully acquire 1440 acres of coal land in this State. For this act it has paid a fine of $8000 and an additional $192,000 for the coal extracted, and has relinquished the land which was acquired through "dummy" entry men as agricultural land. The agents of the Utah Fuel Company also forfeited $14,440 which had been paid for the land.

The Utah Copper Company has placed an order for two new steam shovels and four locomotives for the mine at Bingham. The new additions will give the company a total of 10 steam shovels and 21 locomotives at the porphyry mine. This additional equipment is regarded as substantial evidence of the company's faith in its steam-shovel operations and would indicate an increased tonnage to go to the concentrating mill at Garfield.

Butte

April 12—At the Belmont mine of the Amalgamated the shaft is completed to the 1000 level, and the engine, which was formerly used at the Corra mine, of the Butte Coalition company, has been set in place and is practically ready for operation. This engine is good for at least 3500 ft. The Anaconda shaft is still out of use and will probably be so for some time to come. As soon as the Belmont is connected up with the lower levels of the Anaconda it is probable that the greater portion of the ore will be hoisted through the Belmont shaft; by this means a lift of 400 ft. will be saved, as the collar of the Belmont is about 400 ft. lower than that of the Anaconda.

At the Parrot the vein has been cut on the 2000 level and the showings are said to be satisfactory. Development work is also being carried on at the 1900 level. The Little Mina shaft of the same company has reached a depth of over 1200 ft. and a station is being cut on that level. When the station is completed a crosscut will be run to the vein, which is supposed to be about 500 ft. away.

Denver

April 2—As in the base metals of the ores of Leadville, the San Juan region, Aspen, Georgetown and Red Cliff lead largely predominates, naturally the mining fraternity of this State, having a wholesome fear of the lead of Mexico and British Columbia, is wholly and strongly in favor of a protective tariff and is bringing all the guns it can muster to bear on Washington. And as zinc is largely associated with the ores of the aforementioned districts, the same desire for protection of that metal abides with us. It is stated that at the conference in Salt Lake City of lead-ore producers of Utah, Idaho, Colorado and Nevada, which has just closed there, more than 60 per cent. of these interests in the United States were represented, and the work of compiling statistics and information on the subject, which are to be forwarded to Western senators and representatives, is in the hands of the committees of the new Western Lead Ore Producers Association, which was formed as a result of the conference. So our wishes are likely to be well and strongly put, and will doubtless get an impartial judicial hearing.

In the Cripple Creek district, the output for March is given at 59,704 tons, of a gross value of $1,340,790. The deep drainage tunnel is now beginning to enter that part of the area where mineralized veins may be expected to be encountered; and at 5400 ft. from the portal a fluorine-stained vein is reported as having been intersected. The present breast of the tunnel is now in the phonolite hill known as Grouse mountain, a short distance south of Beacon hill. The Delmonico, on Bull hill, formerly owned by W. S. Stratton, is the scene of a strike reported as four feet of pay ore.

The Ferris-Haggerty and Doane Rambler copper mines, near Grand Encampment, Wyo., together with the smelter, 16-mile tramway, etc., formerly owned by the Penn-Wyoming Mining Company, have passed into the hands of the United Smelters, Railway and Copper Company, capitalized at $10,000,000. The new company is said to have $250,000 in its treasury, and will proceed to develop ore reserves in the mines. This is badly needed as adequate development was not maintained ahead of extraction.

At Georgetown, the 250-ton mill for the treatment of the Pelican dump and customs ores will be started in a few days. At Red Cliff a number of new concentration plants are under construction and will be completed this summer. The mines are busy getting out ore for treatment in these new mills.

In the San Juan region, the Revenue-Virginius of Ouray which has been closed on account of shortage of water is starting up again. The Virginius vein was first tapped by the Revenue tunnel on the Uncompahgre side of the divide, and followed through the main range to the San Miguel side, where the company is working on the Montana, its extension, which has its outcrop in Smuggler Basin. The chief values are in silver and gold.

Great interest was manifested in the Denver visit of Chief Forester Pinchot, who seemed anxious to meet the miners and hear the many complaints made against his policy, and if possible to remedy the wrongs complained of. That the practice of taking up mining claims simply for the purpose of acquiring the timber on them has been extensively carried on is well known, and this the forester very properly means to put a stop to; but that injustice has been done to a great many genuine prospectors by the subordinates of the Forest Service is also certain.

The prospector who has located his claim in good faith and done his best to develop it according to his means, should not be subject to the dictum of a $65-a-month ranger, who has no knowledge of mines or minerals, as to whether he has a valid mineral claim. The present condition of affairs, however, is unquestionably this: that owing to the misplaced zeal, sometimes arrogance and generally ignorance of the subordinates in the Forest Service, hardly any prospecting for metalliferous mines is being done on Colorado mountains which now are nearly all in the national forests. Mr. Pinchot has informed me that in future all disputes with miners and prospectors as to the validity of a claim within the forest reserves will be passed on by a thoroughly qualified mining expert.

Indianapolis

April 5—By virtue of a decree of the Federal Court, Master-in-Chancery Daniels will offer for sale at Bloomfield on May 1, the real estate, personal and mixed property, rights and franchises of the Southern Indiana Coal Company, including the Lattis Creek mine, the Greene County Coal Company mine, Tower Hill mine, Midland mine, Mammoth Vein mine, Linton Semi-Block mine and the Keystone mine; also all the coal and other minerals underlying the surface of a large acreage of lands in Greene county. The sale of this property is regarded as the largest transaction in coal lands and coal-mining property that has taken place in Indiana for some time. The indications are that the sale will attract a large number of investors.

Toronto

April 3—The Ontario government has appropriated $50,000 for the construction of a wagon road from Charlton to Gowganda. A grant of 2,000,000 acres of land will also be made to the Canadian Northern railway as an inducement to construct a line from Sellwood to Port Arthur which, in addition to opening up a fine agricultural region, will tap the Gowganda and other mineral districts. This offer is conditional on the commencement of the road within one year and its completion by the end of 1913.

Mexico

March 26—The movement for the organization of an institute of mining engineers and metallurgists for Mexico is taking definite shape. An organization committee, mostly from Mexico City and vicinity, has held several meetings to formulate the constitution and by-laws and to arrange for a general meeting to perfect the organization, to be held in June or July in Mexico City. The new society will be known as the "Instituto Mexicano de Minas y Metallurgia."

The mining interests of Mexico are still concerned about the effect of the merger of the railroads and the resulting government ownership through a control of a majority of the stock in the consolidated company. The proposed raise of ore rates has been held in abeyance by the Federal commission, because of the depressed condition of mining in the country. It is uncertain when the advance may go into effect, and this is holding back much new work. The government rate commission also has under consideration a raise in freight rates on coal from Gulf ports to protect the growing coal-mining interests of Coahuila and Nuevo Leon from the imported American coal. The smelters and mines are affected adversely by these propositions and have succeeded in securing more or less effective modifications of the proposals backed by the coal-mining interests.

A plant to demonstrate the application of the Delprat & Potter zinc-flotation process will be erected in Mexico City by an English company of which H. Lawrence Read, of Australia, is the managing director. The company controls other processes, and proposes to engage extensively in the testing of low-grade and complex ores in the Mexican field.

The zinc interests of Mexico are much concerned over the proposed zinc-tariff legislation in the United States. The 20 per cent. ad valorem duty which has been imposed during nearly two years has greatly curtailed the operations in Mexico in zinc mining. With the duty removed, the zinc miners are confronted with the arbitrary imposition of a lead-tariff tax on ore containing over 0.3 per cent. lead, with the prospect of the enactment of a new tariff on zinc ore. Some zinc ore is being shipped from Mexico to Europe and it is likely more will go to that market in the future especially if a high tariff results from the campaign in the States.

The smelters of Mexico are now, for the first time, confronted with a scarcity of silicious ores resulting from the general introduction of cyanide treatment, and the curtailing of operations in the silicious silver-ore producing camps due to the low price of silver.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alabama

Southern Steel Company—Notwithstanding the filing of several petitions in the Federal court at Birmingham, Ala., asking for a review of the order of sale in bankruptcy of the properties of this company, there appears to be no doubt that the sale will come off on the date originally fixed, April 12. The reorganized company is prepared to make the purchase. Much litigation is still promised in this case.

CALHOUN COUNTY

Cumberland Mining Company—This company, with headquarters at Knoxville, Tenn., has bought property at Tredegar, where it will mine quartz and put up a grinding plant to turn out pure silica.

Alaska

JUNEAU

Alaska Mexican—February: 120-stamp mill crushed 18,510 tons; estimated value of bullion, $42,308. Saved 343 tons of sulphurets; estimated value, $29,169. Working expenses, $29,177.

Alaska United—February: Ready Bullion claim 120-stamp mill and the 700-ft. claim 100-stamp mill crushed 28,165 tons; estimated value of bullion, $38,893. Saved 476 tons of sulphurets; estimated value, $26,376. Working expenses, $52,024. The 700-ft. claim mill lost several days during the month owing to lack of water, in consequence of the severe weather.

NOME

Reports from the Innoko and Candle districts give promise of satisfactory production and many new strikes have been made. Fifty new outfits are about to begin work at Center creek, in the immediate vicinity of Nome. Twenty outfits are at work on the Submarine beach. The Pioneer Mining Company, on Little creek, is working with full force. A large number of outfits are at work at Black creek on low-grade gravel.

Arizona

COCHISE COUNTY

Bowie District—An aërial tramway is being installed by Mr. Howle to transport ore from his mine to the station. The main working tunnel is now in about 300 feet. It is reported that Mr. Howle is arranging to ship 100 tons daily to the Calumet & Arizona smelter at Douglas. The ore is said to carry a fair amount of gold.

Mascot—Captain Tibbitts is in charge and is reported to be working in good copper ore.

Cowboy—Pence Brothers, owners of the Overland Gold and Copper Company, are doing some development work. The ores carry both gold and copper.

California

CALAVERAS COUNTY

Morgan—When the new air compressor, recently received at Irvine, is ready to run, quite a lot of development work will be done.

EL DORADO COUNTY

Sunshine Mining and Development Company—Final payment has been made on the claims bought of A. A. Macdonald, near Grizzly Flat. B. F. Hulings and Robert Martyr, of Sacramento, who are principally interested, will carry on active mining and install new machinery as soon as weather permits.

INYO COUNTY

The proposed purchase of the Needles smelter by the Tecopa Mining Company has fallen through.

Buckeye—The property in the Fish Spring hills consists of a quarry of low-grade ore. A double-compartment shaft is being sunk.

Harrisburg—This place has had its question of ownership cleared up, and men are grading for a new mill. This is in Skidoo district.

Inyo-Coso—The mine at Junction, 20 miles south of Darwin, is being developed and the mill has been finished.

Lane—Reynolds & Peterson, lessees, are shipping high-grade ore to the smelter at Keeler.

KERN COUNTY

Simmons—This property at Piute has been bonded to R. E. Galloway, J. A. Ross and G. E. Parker. Machinery has been purchased and work begun. The name has been changed to the Monte Carlo Mining Company.

MARIPOSA COUNTY

O. A. Harland and others, of San José, are building a new custom mill at Hornitos to handle ore from the mines of that district which have no mills. There are several dozen small mines in that locality without mills.

Sorrell—This mine, F. L. Wallingford, superintendent, has a new mill which is nearly completed.

Exchequer Mining and Power Company—At the annual meeting the price of electricity per horsepower was fixed at $7 per month for the mines at Hornitos. J. J. LeTourneau, of Duluth, Minn., was re-elected president and Dr. E. S. O'Brien secretary and manager.

MODOC COUNTY

Hess—The quartz mill put up on this mine at Canby has been started. The gold is very fine, and there are doubts as to whether it can be saved by milling without a cyanide plant. This is the only quartz mill in the county.

Fort Bidwell Consolidated—George F. Atkins, secretary, states that a 6-in. streak of ore in the Mountain View claim is panning out very well; and in addition to this there are 6 ft. of ordinary milling ore in the Sugar Pine claim. A 10-stamp mill will shortly be installed.

MONO COUNTY

Lucky Boy—T. J. Hubbard, lessee, is shipping a carload of ore per day. About 70 men are at work. The whole property is being worked by leasers.

NEVADA COUNTY

Native Son—This property, owned by Wisconsin men and managed by J. Bishop, at Nevada city, is to be operated on a larger scale. A new tunnel is to be run.

Champion Mines—Thirty of the stamps are dropping on leasers' ore, and 20 more are working on ore from the Home claim. There are 54 tributers at work, and about 20 more men are working for the company.

Pittsburg-Gold Flat Mines Company—The old drain tunnel has been tapped and is being repaired. The shaft is being repaired down to the drain tunnel. The old water-power hoist has been put in order and the foundations for the new compressor are nearly finished. Excavations are being made for the new electric plant. The Pittsburg will be worked on a large scale when the water is all out.

PLACER COUNTY

Orpheum—At the Ophir, adjoining the Gold Blossom, the electric hoisting and pumping plants have been installed, and a new stamp mill will shortly be purchased.

Lewis Hill—At this property, near Newcastle, a line of operation has been laid out showing that a short extension of the workings northward will open into the pay gravel.

PLUMAS COUNTY

Seneca District—Mark Miller has struck a rich spot in his gravel mine near the old Cariboo diggings. The new quartz mill in Butte valley has had the effect of bringing a number of people into the section. Dunn Brothers have added five stamps to their five-stamp mill.

SHASTA COUNTY

Winthrop—About 70 tons of ore are being shipped daily to the Bully Hill smelter. The completion of the railroad has made it possible to make these shipments from Copper City.

Midas—The clean-up for February approximated $30,000. P. J. Harney has been elected president of the company in place of Captain Roberts, deceased.

SIERRA COUNTY

Downieville—The quartz blocked out at the Grey Eagle mine is of a satisfactory grade. Concentrators are being installed in the Papoose mill. It is expected that the York mine will soon be reopened.

Von Humboldt—Arrangements are being made to reopen this property in American Hill district. Austin & Spencer, sheepmen of the foothills country, are putting up the capital. The district is heavily timbered and well watered. There are both gravel and quartz claims.

SISKIYOU COUNTY

San Jose Ditch—This old ditch, starting about 11 miles above Scott Bar, is being cleaned ont and repaired to bring water to Scott Bar mines.

TRINITY COUNTY

Yellow Jacket—J. F. Tourtelotte, one of the owners of this group in East Fork district, states that the company is driving the tunnel ahead on the pay shoot, and the 30-in. ledge is looking well. A new shaft is also about to be sunk on the ore.

TUOLUMNE COUNTY

Green Spring—J. P. Casaneve and C. E. Wilcox have purchased a half interest in this mine for $15,000, and will pay 20 per cent. of the gross output to the original owners until the last payment is made.

Ellen Winton—E. H. Truett, the new owner, has commenced the work of development.

Jupiter—This mine, near Jacksonville, has been bonded to A. F. Cook, of Alameda, and development work is under way.

Colorado

HINSDALE COUNTY

Indiana & Colorado—W. T. Moneyhun, manager, is planning to erect a concentrating mill on Henson creek, near Lake City.

LAKE COUNTY—LEADVILLE

Iron Silver—The properties of this company were closed for three days, out of respect to the memory of Waldemar Arens, who was general manager and financial agent of the company for 30 years. The mines have resumed operations and are producing about 400 tons daily of different grades of ore.

Little Evelyn—Active prospecting work is in progress in lower South Evans Gulch, through the White Cloud shaft. Several stringers of ore carrying good gold values have been encountered.

Sedalia—This property has been sold at sheriff sale to the Cribbage Mining Company for $50,100. The latter company is closely allied with the Yak Tunnel interests.

Yak Tunnel—The bore is now passing the Fortune territory and entering into Big Evans Basin. It is being driven at the rate of 350 ft. per month.

SAN JUAN COUNTY

Gold King—Between 4000 and 5000 tons of concentrates which have been tied up by the blockade on the Gladstone road, were shipped out during the month of March.

Hercules—The mill on this property is shipping concentrates at a rate of over one car per day.

Tiger—Harry Hilderman and associates, who are leasing a block of ground on this property, have made a shipment of $40 ore.

SAN MIGUEL COUNTY

Crown Point—The old Suffolk mine and other properties at Ophir are to be operated by the newly organized Crown Point Mining and Milling Company. Geo. C. Franklin, general manager. The mill is being remodeled and other improvements are being made. John Lape, superintendent.

TELLER COUNTY

Acacia—The Burns lease is now shipping ore of smelting grade from two ore shoots on the 250-ft. level. In the South Burns mine shipping ore has also been found and royalties between March 1 and March 25 have amounted to $1850. Smelting ore is being shipped from the Morning Star claim. A new shoot has been opened on the extension of the Pinnacle vein.

White City—Ore of low milling grade is being shipped from the surface workings of the Friday claims. A 3-ft. vein of smelting ore has been found on the 200-ft. level.

Lucky Corner—A shipment of five cars of high-grade ore has been made from this mine. The ore has heretofore been brought to the surface through the Ophelia or Moffat tunnel, but a new ore house is now being constructed at the shaft.

Delmonico—A high-grade shoot, liberally sprinkled with sylvanite, has been encountered on the 700-ft. level of this property on Bull cliff.

Ophir—Work is in progress on the new high-grade orebodies recently exposed at the 700- and 1000-ft. levels on Raven hill.

Cripple Creek—New information, charging conspiracy and obtaining money under false pretences, has been filed in the District Court against the six men recently arrested on a charge of "salting" gold ore shipped to the Golden Cycle mill from claims leased by them.

Indiana

GREENE COUNTY

As a result of a conference of mine officials and a Mine Workers' committee from the Island Valley mine near Bloomfield, and officials of the State operators and mine workers' organizations, four of 10 miners suspended for loading "dirty" coal, will be reinstated, and six will be suspended indefinitely. The dirty-coal proposition is the most serious one in the mining fields at present. The wages contract leaves the matter somewhat indefinite as to just how much dirt a miner can load.

Trouble is brewing at the Summit mine over the slate and dirty-coal question. The district officers have ordered the miners to clean up the slate and dirty coal.

Vandalia mine No. 3 near Linton has been closed. This mine is one of the old-timers of this field. The land is about worked out.

A riot occurred among the American and the Hungarian miners at the Bogle mine, three miners being killed and five injured. As a result the foreigners were driven out of the district and the mine superintendents have advertised for additional American miners.

VERMILION COUNTY

Deputy mine inspectors have filed 14 affidavits for violations of the State mining laws at Clinton. Ten of these are against miners for drilling beyond cutting and one against a miner for opening a powder keg with a pick. Three mine bosses are under charges of not conducting the ventilation of the mines properly. They had been working more than 50 persons on one air current, which is contrary to law. The mine inspectors say that there are many violations among the miners and that they have to be very vigilant to keep track of all of them. Men take chances in violating the law in order to make a part of their work easier.

The Miami Coal Mining Company, with offices in Clinton and which owns much good coal land in Vermilion county will soon begin the sinking of a shaft for a new mine near Clinton. H. V. Sherburn, is president.

Maryland

Consolidation Coal Company—The stockholders at the recent annual meeting in Baltimore, voted to increase the capital from $10,250,000 to $20,000,000. Of the new stock $6,150,000 will be issued to present stockholders as a dividend of 60 per cent., representing additions to property made out of earnings. The remaining $3,600,000 will be held in reserve, to provide for future additions.

Michigan

Copper

Keweenaw—Stamping at the Phœnix mill was discontinued after running an extensive test on the Medora shaft rock, the results being unsatisfactory. At the 11th level drift a formation known as the west fissure vein, was encountered, but upon farther opening at the 13th level it was found practically barren. Further development work will be carried on from this point, and during the summer, openings will be made on the Osceola and Kearsarge lodes. The office of the company was recently moved from New York to Hancock, with C. A. Wright, Jr., secretary and treasurer in charge.

Hancock—The crosscut which connects No. 1 and No. 2 shafts at the 13th level is completed. This will be the main working passageway through which all the rock from the levels above will be hauled to No. 2 shaft. This shaft is below the 18th level, and at that point preparations are under way to drive another crosscut to the Hancock lode. This crosscut will handle the rock between the 13th and 18th levels.

Copper Range—The improved conditions in the Trimountain property continue. The best showing is at No. 4 shaft in the drifts below the 11th level. Shafts Nos. 2 and 3 are opening better ground at the 14th level. Diamond-drill operations are in progress on sections 7 and 8, which are held under option from the St. Mary's Mineral Land Company.

Quincy—The wooden shafthouse over the Pontiac has been completed. This shaft is down about 350 ft. in encouraging copper ground.

Franklin—The Pewabic lode has been reached at the 25th level by means of the crosscut and the formation is well charged with copper. Drifting continues on this lode at the 13th and 24th levels with undiminished richness.

Arcadian—At a meeting held at Houghton reorganization was perfected. The new company is to be known as the New Arcadian, organized under the laws of Michigan with a capital of 150,000 shares, par value, $25, $10 paid in. The old officers and directors were reëlected. It was also decided to give the New Baltic Exploration Company an option on the quarter section of land in Section 16.

Victoria—Good copper-bearing ground continues to be exposed at the drift extending from the 22d level; this is the most important development at the property in a long time. The mine is operating on ore yielding about 13 lb. of copper to the ton. The hydraulic plant is being hindered in its operation by lack of sufficient water due to the continued cold weather.

Seneca—This company is drifting from the first level of its shaft at a distance of 200 ft. from surface. The formation is badly shattered with very little copper showing.

Ojibway—The crosscut from the 650-ft. level of No. 2 shaft has reached the lode. The shaft is down to the 800-ft. level. At No. 1 shaft sinking continues toward the 800-ft. level.

Ahmeek—The structural steel for this company's new stamp mill has been delivered and is being rapidly erected. Excavating is under way for the pumping station. Work at the two new shafts is being vigorously pushed. At the central crushing plant, which handles the rock from the two producing shafts, a large electric motor has been installed to drive the two 24x36-in. rock crushers.

Lake—The shaft is sinking below the third level. At the third level the crosscut is being driven westward to cut the main lode.

North Lake—Diamond-drill hole No. 3 is down over 700 ft.. The No. 4 hole is down about 225 ft. and entering the ledge. Nothing of any importance has been revealed.

Mass—A new copper-bearing lode was opened by means of a crosscut driven from the 27th level of "A" shaft. This lode is about 125 ft. from the Evergreen lode, which, together with the Knowlton, have been the main working formations of the company. The location of this lode was first revealed by a diamond-drill core.

Michigan—This company has opened an old adit and has found a very encouraging grade of stamp rock.

Tamarack—The report for the year 1908 shows a loss of $153,217 incurred by operations. Rock stamped, 654,897 tons; mineral obtained, 19,134,429 lb., containing 66.93 per cent. refined copper, or 19.6 lb. of copper per ton of rock. The total cost of the refined copper was 15.24c. per lb. Mining, smelting and other expenses were $1,870,191; construction, $32,851; exploration work, $49,537; assets, $1,791,450; liabilities, $1,314,114; balance of assets, $477,366.

Nevada

Esmeralda County—Goldfield

February Premier Lease—Fifteen men are employed. A crosscut is to be run east from the 220-ft. level.

Goldfield Consolidated—Development work on the new strike proves the extent of the orebody to be larger and richer than first reported. Eight cars of ore recently shipped to the Western Ore Purchasing Company yielded returns in excess of $150,000.

Esmeralda County—Mina

Marble Quarry—Davis Brothers, of Yerington, recently purchased the quarry, and will equip it with modern quarrying machinery. They also own 60 acres adjoining, thus making a property of about 125 acres. The marble is jet black traversed with green, gold- and copper-colored veins and takes an extremely high polish.

Esmeralda County—Hawthorne

Lucky Boy—The Alamo lease paid its first dividend March 24, amounting to $25,000, or 10c. per share. At present the mine is shipping an average of 1000 sacks of ore per day. Sixty men are now employed at the lease and 125 horses are engaged in hauling the ore to Hawthorne, six miles distant.

Humboldt County—Winnemucca

Rose Creek—Molybdenite has been found in several places by A. Zeidler on a group of claims about 10 miles west of Winnemucca. A shaft will be sunk and prospecting carried on.

Humboldt County—Seven Troughs

London Syndicate—Work is being rushed on the mill as fast as possible. The tube mill was shipped from San Francisco March 20. The sampler is being put in place and the cyanide department is nearly completed.

English George—The clean-up of a 10-days' run in the Badger Hill mill resulted in 65 lb. of amalgam valued at nearly $4000. The ore from the lease is now averaging between $15 and $20 per ton.

Reagan—The clean-up in the Mazuma Hills mill treating ore from this lease resulted in a recovery of over $6000 for 100 tons of ore treated.

Humboldt County—Chafey

Chafey Mines Company—This is a newly organized company, capitalized at $1,000,000 in $1 shares. The company will operate the Black Hole property and two additional groups of claims. Mr. Chafey is president of the company and H. C. Oastler, secretary.

Lyon County—Buckskin

Kennedy Consolidated—Work is to be resumed by Stebbins & Green who have a two-years' lease. Water has been encountered in the shaft, now 210 ft. deep, and a pump will be installed.

LYON COUNTY—YERINGTON

Nevada-Douglas—L. Humphrey, consulting engineer, in a report to this company, estimates 599,530 tons of 5.4-per cent. copper ore available. He also estimates 246,700 tons of probable ore averaging 3.69 per cent. copper.

LINCOLN COUNTY—PIOCHE

Maopa Forest—The president has signed a proclamation creating an addition of approximately 45,000 acres to the Moapa national forest reserve. This addition is at the northwest corner of the Charleston division.

Nevada-Utah—The body of silver-lead ore opened on the 700-ft. level of the Day mine is now said to show a width of 130 ft. and limits not yet reached. The same body of ore has been opened on the 600-ft. level and on the 800-ft. The ore is said to assay 10 to 15 per cent. lead and 20 to 40 oz. silver per ton.

Great Eastern—A large body of ore containing copper, nickel and platinum has been cut on the third level of this mine at Bunkerville.

Lead King—The owners of this mine have given a lease to some Goldfield operators, who expect immediately to inaugurate developments.

NYE COUNTY—BULLFROG

Montgomery Shoshone—It is estimated that the tonnage for March was in the neighborhood of 6000 tons. Eleven bars of bullion were shipped during the week.

Tramps Consolidated—A car containing 18 tons was shipped last week to Needles by three sets of leasers. The bulk of the shipment came from the Kuliachi-Vucovich lease on the fourth level.

NYE COUNTY—JOHNNIE

Johnnie Consolidated—As a result of 13 days' run at the mill a bar of bullion worth $10,000 was shipped from the property last week. About 100 tons are treated daily, by the 15 Nisson stamps. The shaft is 750 ft. deep.

WHITE PINE COUNTY

Giroux—In the report for the year ending Jan. 31, 1909, the president states that milling was commenced in November, but the crushing machinery proved inadequate. Additional Chilean mills and rolls brought the work up to estimated capacity. The ratio in concentration was about 12½:1. The Alpha shaft was continued to the 1200-ft. level, the flow of water increasing with depth. A winze sunk on the orebody showed a width of 4 to 40 ft., the high-grade ore being maintained for a distance of 140 ft. Early in January a crosscut driven to connect with this winze penetrated a body of massive copper ore. About the end of 1908 a proposition was made to purchase the property for $6,000,000, which offer was declined. This was followed by the purchase of a large interest in the company's stock by Thomas F. Cole and associates. Energies will still be directed to the development of the ground opened by the Alpha shaft, which is confidently expected to show a large deposit of high-grade carbonate and sulphide ore. Further developments will be prosecuted in the porphyry ore to permit of milling on a larger scale. A large portion of the porphyry deposit can be mined by steam shovel. At present the treasury has $1,000,000 available.

Cumberland-Ely—Production in March was 1,636,171 lb., compared to 1,233,492 in February, and 1,094,218 in January.

Nevada Consolidated—Production in March was 2,169,088 lb., compared to 1,035,000 in February, and 1,451,000 in January.

Montana

BUTTE DISTRICT

British Butte—The dredge at this property has been closed down due to the burning out of one of the motors. Operations will be resumed as soon as the necessary repairs can be made.

Butte Superior—It is stated that a zinc mill will be erected near the Black Rock shaft of this company. Large bodies of zinc ore have been opened up in recent development.

East Butte Extension—Operations have been resumed. The work is being done at a depth of 250 ft., the bottom level of the property.

Tuolumne—Work has been partially suspended while the new equipment is being put in place. The shaft has reached a depth of 1395 ft. It is expected that crosscutting for the vein on the 1400 level will be in progress before May 1.

JEFFERSON COUNTY

Corbin District—Four tunnels are being driven on the claims of the Corbin Copper Company. Stephen R. Dow, president, has charge of the work.

New Jersey

SUSSEX COUNTY

A corps of engineers and assistants has been exploring the workings of the old zinc mine at Ogdenburg, which has been closed for a number of years. This has given rise to a report that the mine will be reopened.

North Carolina

JACKSON COUNTY

Consolidated Nickel Company—Machinery is arriving and being erected at the mine and smelter, near Webster.

Oregon

GRANT COUNTY

Comer—These cobalt mines were not operated during 1908. However, it is expected that work will be resumed in 1909.

LANE COUNTY

Black Butte Quicksilver—J. B. Rouse, lumberman, has begun suit against this mining company to recover money which he claims is due him.

Le Roy—The management intends to resume work when patents are secured. The mine is equipped with air drills and a compressor plant.

Pennsylvania

BITUMINOUS COAL

Isabella-Connellsville Coke Company—This new company has secured control of practically all of the coal lands recently bought by J. V. Thompson, of Uniontown, in Fayette, Greene and Washington counties. The purchase is the largest area of coking coal in Pennsylvania, outside of that owned by the H. C. Frick Coke Company. The managers of the new company include John C. Bryden, who is president; Daniel Beach, L. G. McCrum, J. R. Nutt and other well known coal and iron men of Pittsburg and Cleveland. Charles M. Schwab, of the Bethlehem Steel Company, is also said to be interested.

ANTHRACITE COAL

In the appeals of the Delaware, Lackawanna & Western and other companies from the decision of the Circuit Court, the Pennsylvania Supreme Court has reversed the decision of the lower court, and holds that there must be a reassessment of the property of the companies. The ground of the reversal is that the coal property was assessed for taxation at a higher percentage of its value than surface property. The appellants are, therefore, entitled to a reassessment on a uniform rate of valuation.

Plymouth Coal Company—This company has resumed possession and operation of the Dodson and Black Diamond collieries near Wilkes-Barre, the receiver having been discharged by the court. John C. Haddock, president of the Company, announces that the sum of 1c. per ton of coal mined will hereafter be set aside as a trust for the benefit of employees who may be injured in the collieries.

Philadelphia & Reading Coal and Iron Company—This company's statement for February and the eight months of the fiscal year from July 1 to Feb. 28 is as follows:

	February.	Eight Mos.
Earnings	$2,497,771	$22,803,425
Expenses	2,511,804	21,642,155
Net or deficit	Def. $ 14,033	N. $1,161,270

For the first time this year the expenses for the month exceeded the receipts.

South Dakota

Custer County

The Westinghouse mica mill, near Custer, has resumed after a month's shutdown. No cause for the suspension has been given out. The raw product from this mine is shipped to Denver.

Lawrence County

Elliptic—Much interest has been aroused by the discovery of free-milling ore in the Maitland district. The ore is similar to that of the Homestake and intensifies the belief that the great Homestake ledge continues northwest at an increasing depth.

Homestake—At the regrinding plant hard quartz ore from the lower workings has been substituted for imported pebbles in the tube mills.

Definite information is now available in regard to the hydroelectric plant planned by the Homestake company. Work is to commence May 1, and the plant should be in operation by November, 1910. The capacity is to be 7000 horsepower and the power is to be used in the stamp mills, regrinding plant, the two leaching plants, the slimes plant, the machine shop, foundry and pattern shop. For the stamps alone, 2500 h.p. is required, while the compressor at the Ellison hoist will use 1000 more. The entire flow will be taken from Spearfish creek, four miles below Savoy, carried about six miles through a 7x6-ft. concrete-lined conduit with a fall of 700 ft. Eight tunnels varying from 2000 to 4000 ft. will be driven, for which work eight 5-h.p. electric drills will be used. The total cost is estimated at $1,000,000.

Tennessee

Tennessee Copper—It is rumored that the directors will not declare a dividend covering the operations for the last six months. The matter of a contract for disposal of the sulphuric acid output of the company is still in the air.

Utah

Beaver County

Cedar-Talisman—Sinking and drifting on the 500-ft. level is now under way and the property will be in shape to ship ore in the near future.

Utah Gold and Copper—The main tunnel on this property has entered the second vein 15 ft. without finding the wall. The upper tunnel shows a large amount of lead ore and plans for the erection of a mill are now being made.

Beaver Combination—D. H. Ferguson of the Cedar-Talisman has been put in charge of this property also and development work is to be undertaken at once.

Juab County

Ajax—The mine is shipping about 500 tons per month, part going to the Tintic plant and part to the Salt Lake smelters. Development work is being done on the 1000-ft. level.

Opex—The shaft has reached the 2000-ft. level, and will be continued for a distance of 500 ft. before drifting is started. The company is expecting to find the extension of the Centennial-Eureka orebodies.

King William—Development work on the 500- and 1000-ft. levels is being carried on through the Eagle and Blue Bell shafts.

Centennial-Eureka—The large body of ore found on the 2000 level resulted in continuing the sinking of the shaft to a depth of 2225 ft. A station is now to be cut and sinking of the shaft discontinued until an electric pump can be installed to handle the water, after which the shaft will be sunk to the 2500 level.

Utah Consolidated—The shaft of this Tintic property has attained a depth of 300 ft., and it has been decided to sink to the 400 level. Th crosscut from the 300 level has gone a distance of 250 ft. and work is to be continued until the orebody is encountered.

Mammoth—A considerable tonnage of ore is being piled up by leasers at this mine awaiting satisfactory smelting arrangements.

Tintic Smelter—Ore is being received from outside the Tintic district from such properties as the Dalton & Lark, of Bingham, the Yellow Pine at Gene, Nev. and the Horn Silver at Frisco.

Bullock—Ore of the smelting grade has been encountered in the crosscut on the 210-ft. level.

Iron Hat—A contract has been let to Fred Wahlberg and Conrad Anderson to sink the shaft 100 feet.

Salt Lake County

Bingham-New Haven—The General Engineering Company of Salt Lake has been awarded a contract for a 100-ton concentrating mill at Bingham. The mill is to be in operation by July 1.

Bingham Central-Standard—Shipping ore has been found in the last 100 ft. in the Mountain Maid tunnel which is being worked on company account. Leasers on the Jeff Davis and Moscow tunnels are also taking out shipping ore.

Summit County

Keystone—At a depth of 150 ft. in the incline shaft from the tunnel, 8 ft. of second-class ore have been found.

Tintic-Silver Crown—M. L. Snow, manager, announces the sale of 381,000 shares of treasury stock to Eastern men, and extensive development work will be started at once on the 540 acres controlled by this company.

Tooele County

International Smelting—The contract for grading for the site of the new smelting plant in Pine cañon has been let to the Ely Construction Company.

Virginia

Tazewell County

Big Vein Pocahontas Coal Company—This company recently leased a large tract of coal land, on which are two small mines. One of these mines will be closed for the present; the other will be enlarged and provided with new machinery, increasing its capacity to 1500 tons daily. Thomas T. Boswell, Baltimore, Md., is president.

Washington

Snohomish County

Arsenic Tariff—The Everett Chamber of Commerce adopted a resolution requesting congress to secure the imposition of a tariff on arsenic to the extent of at least 1½c. a pound on the mineral in the ores, and 2c. on white arsenic. F. H. Brownell, local attorney for the American Smelters Securities Company, states that the total consumption on this continent is about 7000 tons annually, and that the maximum production of 1500 tons at the Everett plant has led to a reduction in price by European producers who pay 30 per cent. less wages and have the advantage of cheap water transportation.

Monte Cristo—This property is reported sold to the American Smelters Securities Company, a transaction which in part is verified by its attorney, F. H. Brownell.

Snohomish County—Index

Nonpareil Copper—This company will resume mining operations. Supplies are being packed up to the mine, and the drift in which a vein of copper ore was uncovered last fall will be continued.

Chewawa Lead and Smelting—At the mine on Red mountain a tunnel has been driven about 375 ft. Several orebodies have been crosscut. The outlook for the mine is very bright and the owners are greatly pleased with the progress made.

SNOHOMISH COUNTY—SILVERTON

Imperial—A strike of high-grade ore was made recently at this mine. The ore is gold-bearing.

West Virginia

KANAWHA COUNTY

Kanawha Collieries Company—This new company has bought the coal land and mine at Graham Mines, on the line of the Coal and Coke Railway. Electrical equipment and other new machinery will be installed at the mine. E. D. Leach, Moundsville, W. Va., is president of the new company.

MONONGALIA COUNTY

Arrangements are being made to open up the Millholland tract of 12,000 acres, owned by the Fairmont Coal Company.

Canada

BRITISH COLUMBIA

Crow's Nest Pass Coal Company—The coal-handling plant built by the C. O. Bartlett & Snow Company, of Cleveland, O., at the Michel mines, was started up in February, and is now handling the entire output of the mines. It is the largest plant of the kind in Canada. It is stated that this plant does the same work with 17 men in 12 hours that formerly required 68 men working 12 hours.

BRITISH COLUMBIA—ROSSLAND

Consolidated Mining and Smelting Company—A fire on the 400-ft. level of the Center Star mine did considerable damage to mine timbers before it was extinguished. A large force of men was engaged about 20 hours fighting the fire, under the supervision of W. H. Aldridge, managing director, R. H. Stewart, mine manager and M. E. Purcell, superintendent. Work has been resumed in the mine.

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore from Cobalt for the week ended March 27 were as follows: Crown Reserve, 114,540 lb.; Cobalt Central, 40,000; Chambers-Ferland, 60,000; City of Cobalt, 53,592; Kerr Lake, 62,000; La Rose, 260,000; Nipissing 258,770; Right-of-Way, 62,008; Temiskaming & Hudson Bay 46,600; total 957,510 pounds.

Beaver—The annual meeting was held in Toronto March 29, when the shareholders granted authority to the directors to increase the capital stock from $1,500,000 to $2,000,000, in order to provide funds for continuing development operations, with the proviso that the new issue should not be sold at less than 10 per cent. of its par value.

Little Nipissing—Good ore has been struck in the vein on the Peterson Lake lease in drifting at the 160-ft. level. The vein, 10 in. wide, has become rich in native silver estimated at 2500 oz. to the ton.

Temiskaming—A vein with good silver contents about 10 in. in width has been discovered at a depth of 250 ft. where the drift was continued into the Gans location.

ONTARIO—GOWGANDA DISTRICT

Bartlett—H. T. Pemberton, manager, recently brought samples of ore to Toronto from vein No. 1 on the southwest claims, weighing about 900 lb. Two specimens, weighing over 150 lb. each are almost solid calcite and silver.

NOVA SCOTIA

Dominion Coal Company—This company and the Dominion Steel Company, on March 30, entered into two agreements with a view to the settlement of the dispute over the coal contract which is involved in the pending litigation, the coal company at the same time making a payment of $2,750,000 on account of the damages claimed by the steel company. The agreements are given at length in the *Montreal Gazette* of March 31; the substance is as follows: The coal contract of Oct. 20, 1903, is declared to be in full force and effect and the steel company is permitted within 10 days to deliver to the coal company notices of its requirements of coal for April, May and June, 1909, not exceeding 80,000 tons per month.

The steel company may in the pending action recover damages suffered from Aug. 1, 1906, to date, but no damages shall be assessed therein for the unexpired term of the contract. Neither party shall be precluded from bringing action for any breach of the contract which may hereafter occur.

The steel company is to file a statement of the particulars of its claim, and within two months also a complete detailed supplementary statement of all damages caused by the short deliveries of coal by the coal company, or the partial shutting down of the steel company's works by reason thereof, the coal company to have four months (exclusive of delay caused by the steel company) to verify the particulars of the claim, and for that purpose to have the right to examine the works, books, accounts and documents of the steel company.

The payments on account shall be without prejudice to the right of the coal company to dispute any of the items of the steel company's claim.

After the conclusion of the examination an amicable settlement of the litigation is to be reached, if possible, before proceeding to assess the damages claimed before the referee appointed by the court.

YUKON—DAWSON

Much activity prevails, in connection with the opening of the mining season. Many people are coming in from "the outside," chiefly by stage or private conveyance from Whitehorse, while scores of teams are hauling supplies to the various creeks. Mining companies are hurrying their preparations for either ordinary hydraulicking or dredging. The Guggenheim interests, especially, are preparing for extensive operations throughout the ensuing season; beside putting on hundreds of men at mining, they will build 12 miles of new ditch on Bonanza creek. Other power schemes are being worked out and more dredging enterprises will be undertaken than in any previous year.

Mexico

CHIHUAHUA

Burns & Daly—A strike of good copper ore is reported about 15 miles from Ahumada. A small shipment was recently made to the El Paso smelter. This property was denounced last year by J. L. Hollister, but is now owned by Burns & Daly.

Mexicana—A good grade of zinc ore is being shipped to the Kansas smelters. The property is 20 miles west of the Burns & Daly mine.

Mexico Northwestern Railway Company of Canada—S. F. Pearson, president; E. D. Kenna, Enrique C. Creel and Walter Gow, vice-presidents. This company has lately been organized and incorporated in Canada to build and operate railroads in northern Mexico. Capital stock, $40,000,000.

MEXICO

Esperanza—February: Mill, 22 days, crushed 11,569 tons of dry ore. Concentrates and 31 tons of ore shipped to smelter. Estimated value of bullion produced, $116,809; estimated value of concentrates, $31,569; receipts from rents and other sources, $438. Total, $148,816. Less—Working expenses, including development, marketing of bullion, and freight and treatment charges on concentrates shipped to smelter, $93,980; allowance for depreciation of plant, $2500; consulting engineers' fees and New York office expenses, $2187; total, $98,667. Balance, $50,149. Estimated profit, £10,026. Of this there has been expended on construction account $2136. Feet of development work, 968. Low profit is due to smaller tonnage of ore treated, arising from the continued changing over from the old to new mill, and the short month.

SONORA

Greene-Cananea—Production in March was 4,000,000 lb., compared to 3,804,000 in February and 3,848,000 in January.

South America

BRITISH GUIANA

Exports of gold for the two months ended Feb. 28 were 7417 oz. bullion in 1908, and 8081 in 1909; an increase of 664 oz. The bullion reported this year was equal to $130,609, or 6754 oz. fine gold.

Exports of diamonds for the two months were 307 carats, of $1846 value.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, April 7—The anthracite labor question is still unsettled, although no strike nor lockout has taken place. The companies agreed to a continuance of work under the existing agreement for a short time, or until further negotiations could be carried out, and work is continuing at the mines as usual. It is not expected, however, that this arrangement will continue long and a decision one way or the other will undoubtedly be forced as soon as possible. A conference between representatives of the operators and those of the mine workers is being held today, but may continue for several days before any result is reached. It is undoubtedly the purpose of the mine workers to prolong the negotiations as much as possible; and it is equally the determination of the operating companies to tolerate as little delay as they can. It is not impossible that matters may be settled at the conference now in progress.

The Eastern bituminous trade continues quiet. A fair amount of business is being done, but nothing like that of 1907. The demand for steam coal increases slowly.

In the West reports are rather more cheerful, a better demand for steam coal being noted, and mines are working more steadily throughout Indiana and Illinois.

The coke market has rather suffered from overproduction, and this week the Frick Coke Company shut down 600 ovens, while independent producers banked 500 more in the Connellsville region.

Panama Contracts—The contract for 400,000 tons of coal for the Panama railroad during the coming year has been awarded to W. C. Atwater & Co. at $2.39 per ton for Pocahontas coal, f.o.b. Newport News.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to March 27, short tons:

	1908.	1909.	Changes.
Anthracite.....	1,209,280	1,164,953	D. 44,327
Bituminous.....	8,093,033	8,387,857	I. 294,824
Coke.....	1,718,252	2,375,772	I. 657,520
Total.....	11,020,565	11,928,582	I. 908,017

Total increase this year to date was 8.2 per cent.

The total coal production of Ohio in 1908 is reported at 26,268,239 short tons. This compares with 32,365,949 tons in 1908, showing a decrease of 6,097,710 tons, or 18.8 per cent. Of the total last year 21,621,046 tons, or 82.3 per cent., were mined by machines.

New York

Anthracite

April 7—The market continues quiet and business is going on steadily as though there was no controversy impendent. Trade is about as usual and domestic sizes are in abundant supply. Steam sizes are still rather scarce.

Prices under the April circular are $4.25 for lump and $4.50 for egg, stove and chestnut f.o.b. New York harbor points. For small steam sizes prices are nominally unchanged as follows: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.60@2; barley, $1.35@1.50; all f.o.b. New York harbor points. Advances from 10c. per ton up are still asked by commission merchants.

Bituminous

The soft-coal market remains quiet, with very little change from the last report. Contract making continues slowly and probably about one-half of the yearly contracts usually closed in this market have been concluded, most of them at prices a little under last year. Current business may be said to show a little improvement; that is, more coal is being sold than there was a year ago. It is noticed that orders coming in are generally accompanied by a hurry clause indicating that stocks in the hands of consumers are very low. The different consuming districts are running about even, the far East, the Sound and New York harbor being about the same. All rail trade is better than Seaboard, as it has been for some time. Transportation is good and cars are in plentiful supply. There is no stock of coal pressing on the market anywhere, as producers have fallen into the habit of shipping coal only on orders.

Prices continue low. Good grades of steam coal can be had at about $1.25@1.35 at mine; poorer grades as low as 90c.@$1 at mines. Gas coal brings from 85c.@$1.10 for ¾-in.; 75@85c. for run-of-mine and 60@65c. for slack, all at mines.

In the Coastwise trade vessels are still hunting for charters. Rates are unchanged from last week's report, although a few of the larger boats have shaded prices 5c. in order to get full cargoes.

Birmingham

April 5—The coal market in Alabama is quiet and the production is off considerably. More mines have been shut down. The starting up of a couple of batteries of coke ovens is the only encouraging feature for the week. One of the principal traffic companies in the district reports that the business has fallen off at the mines and that the greater portion of the product being handled right now is for company use.

Coke is in a little better demand than it has been and there is hope of a continuation of the improvement.

Chicago

April 5—Except on lump sizes the shipments of Illinois and Indiana coals are well regulated to demand in the Chicago market now, and prices consequently hold up well. The demand for domestic coals is small and decreasing; for steam coals it is steady and increasing slowly. Fine coals are in growing demand, but the supply is so large from Western mines that no large increase in price is probable. Screenings now bring $1.40@1.60; run-of-mine sells for $1.65@1.75, and lump or egg for $1.75@2.30.

Eastern coals in general continue strong, smokeless especially holding up close to circular prices, in contrast to the demoralization caused by overshipments a few weeks ago. Neither lump nor run-of-mine smokeless is in too great supply now, operators having generally restricted their shipments. Smokeless finds fair sale at $3.20@3.45 for lump and $3.05@3.15 for run-of-mine. Hocking is somewhat weak; too much has been received for stability of the list price of $3.15, which has been cut to as low as $2.75, most sales being made at $2.90@3. Youghiogheny is in quiet, steady movement at $3.15 for ¾-in. gas coal; Pittsburg No. 8 brings $2.65@2.75 for the same size.

Anthracite moves well under the April discount, retailers and consumers showing a disposition to lay in stocks early, and sales for immediate consumption are fairly good.

Cleveland

April 6—The coal trade is improving a little, dealers reporting a better demand for steam coal. Shipments from mines are not rushed, and there is little demurrage coal on the market.

Little is doing yet in the Lake trade, and it is evident that there will be a late opening. Reports from the Northwest are that stocks are still large.

Indianapolis

April 6—Indiana coal-mine operators say that the winter season is practically

at an end, but that manufacturers are ordering larger quantities of steam coal regularly. From this time on the operators will begin to provide for the demand that usually comes in June and August for storage supplies from dealers.

An order has been entered in the Federal court directing John K. Seifert, as receiver for the Indiana Southern Coal Company, to enter into a contract with the American Steel and Wire Company to supply that company with 250 to 300 tons of coal a day from April 1, 1909, to April 1, 1910. The contract price is 87½c. per ton.

Pittsburg

April 6—Considerable new business has been taken during the past few days at cut prices. Producers are still quoting on the basis of $1.15 for mine-run coal, but contracts have been closed at $1.10 and some as low as $1.05 a ton. On a large contract even this rate might be shaded. The most important contract of the week was taken by the Pickands-Magee Company calling for one-half of the year's fuel supply for the Grand Trunk Railroad, or 150,000 tons, deliveries to be made at Conneaut Harbor, beginning on May 1. The coal will come from the Bessemer district and will insure the steady operation of the Pickands-Magee Company's mines. Shipments to Lake ports for the northwestern markets have been begun on a small scale and several cargoes have gone out in small boats from Cleveland. The railroad mines in the Pittsburg district are not being operated to more than 60 per cent. and there is a scramble for all the business going. The river mines continue in full operation and a fairly large tonnage of coal has been accumulated in coal boats and barges.

Connellsville Coke—The coke trade is discouraging. Fully 1200 ovens have been put on the idle list within the past 10 days and others likely will go out this week. The H. C. Frick Coke Company has closed about 600 ovens. A number of blast furnaces that receive coke from the Connellsville fields have been blown out and others are scheduled to go out before May 1. Favorable progress is being made in the project to form a combination of all the coke interests outside of the big corporation. Furnace coke for spot shipment is still selling at $1.50@1.60; some concerns are holding for $1.75 on contract coke; it is believed $1.60 can easily be done for deliveries running to July 1. Foundry coke remains at $1.90 for spot and $2@2.15 on contract. The *Courier* gives the production in both fields at 237,741 tons. The shipments were 8787 cars as follows: To the Pittsburg district, 3279; to points west of Pittsburg, 4641; to points east of Connellsville, 867 cars.

Foreign Coal Trade

United States Coal Imports—Imports of coal and coke into the United States, two months ended Feb. 28, long tons:

	1908.	1909.	Changes.
Anthracite	11,914	3,114	D. 8,800
Bituminous	305,724	208,103	D. 97,621
Total coal	317,638	211,217	D. 106,421
Coke	31,134	28,594	D. 2,540

Canada furnished this year 166,504 tons coal and nearly all the coke; Australia, 31,474 tons coal. Imports are chiefly on the Pacific coast.

United States Coal Exports—Exports of coal and coke from the United States, with coal furnished for the use of steamships at all ports, two months ended Feb. 28, long tons:

	1908.	1909.	Changes.
Anthracite	301,267	297,096	D. 4,171
Bituminous	1,222,038	1,000,130	D. 221,908
Total exports	1,523,305	1,297,226	D. 226,079
Steamer coal	982,458	871,306	D. 111,152
Total	2,505,763	2,168,532	D. 337,231
Coke	131,016	155,917	I. 24,901

Canada took this year 879,874 tons, or 67.8 per cent. of the total coal. The coke goes chiefly to Mexico and Canada.

French Coal Production—The total coal production of France for the years named was, in metric tons:

	1907.	1908.	Changes.
Coal mined	36,930,250	36,770,211	D. 160,039
Coke made	2,107,342	1,954,760	D. 152,582
Briquets made	2,192,745	2,016,881	I. 175,864

The change in the total coal production was unimportant.

French Coal Trade—Official statement of fuel exports and imports in France, full year, metric tons:

	1907.	1908.	Changes.
Exports:			
Coal	1,166,400	1,092,106	D. 73,294
Coke	169,840	150,783	D. 19,057
Briquets	113,410	129,369	I. 15,959
Total	1,448,650	1,372,258	D. 76,392
Imports:			
Coal	14,868,967	14,732,530	D. 136,437
Coke	2,175,715	1,826,350	D. 349,365
Briquets	694,120	1,012,320	I. 318,200
Total	17,738,802	17,571,200	D. 167,602

Exports in 1908 included 115,697 tons coal and 53,217 tons briquets furnished to steamships in foreign trade.

Austrian Coal Production—Coal production in Austria for the full year was as follows, in metric tons:

	1907.	1908.	Changes.
Coal	13,850,420	14,091,161	I. 240,741
Brown coal	26,262,110	26,669,709	I. 407,599
Total mined	40,112,530	40,760,870	I. 648,340
Coke made	1,879,189	1,915,434	I. 36,245
Briquets made	295,145	339,686	I. 44,541

Of the briquets made in 1908 there were 191,869 tons from brown coal, or lignite.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on March 27: Best Welsh steam, $3.48; seconds, $3.36; thirds, $3.24; dry coals, $3.48; best Monmouthshire, $3.06; seconds, $3; best small steam, $2.22; seconds, $2.04. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, April 7—The iron and steel markets show a variable improvement; while still slow in some directions there is a manifest advance in others.

Pig iron has been rather quiet. Early in the week one or two considerable contracts were reported for basic pig for Western delivery at prices not made public. There is considerable inquiry in the East for foundry iron, but less in that line is doing in the West. Prices are rather indefinite, but those for foundry have been seriously affected by the action of Southern makers in taking contracts as low as $11 and even $10.50 Birmingham for No. 2 foundry.

In finished material there has been a great deal of activity in structural steel and in bars, while plates have sold rather freely. The structural market has been especially active and some large contracts for buildings have been placed. An improvement in the demand for nails and other minor products is reported, indicating an increase in general building throughout the country.

While new orders for rails are still scarce, the railroads are taking on a good deal of bridge material, and some orders for equipment are reported.

Bethlehem Steel Company—The report of this company for 1908 shows that the total orders received for the year were $14,458,997, a decrease of $1,156,021 from 1907. Net income was $2,192,355, a decrease of $446,602; net surplus over charges and depreciation, $386,864, a decrease of $1,231,925. The uncompleted orders on hand Dec. 31, 1908, amounted to $7,592,502, a decrease of $992,163 during the year. The number of employees at the close of 1908 was 8615, being 1168 less than at the end of the previous year.

Baltimore

April 6—Exports for the week included 776 tons of steel rails and rail fastenings to Vera Cruz. Imports included 1508 tons ferromanganese and 3 tons silico-spiegel from Liverpool; 10,500 tons iron ore from Cuba.

Birmingham

April 8—An encouraging feature in the Southern pig-iron market is the fact that inquiries are coming in. The market is quite dull. The sale of another good lot of iron for use in manufacturing cast-iron pipe is reported in this district, an Eastern pipe concern making the deal. The quotations are between $11@11.50 per ton, No. 2 foundry. Two or three of the larger companies are holding their iron at $11.50 per ton, and one company in particular is said to have notified some of the larger consumers in the North that there is no necessity to sacrifice the product, and that

the carrying of the same until better times would not be difficult. There has been a little accumulation of iron in this territory, but not to any alarming extent. There has been no further curtailment of production recently.

The rumors still prevail that there is to be a shutdown of the steel plant of the Tennessee company in the next few days, but nothing definite is given out at the local offices.

The cast-iron pipe plants in the Birmingham district have their hands full, and shipments are steady.

Chicago

April 5—The pig-iron market continues to wait on the laggard melter who is postponing his buying until he feels sure that the bottom of the market has been reached. Buying is in small lots for second and third quarters at $10.50@11, Birmingham ($14.85@15.35 Chicago), for Southern No. 2, and $16@16.50 for Northern No. 2. On much business $11 is obtained for Southern and on some still more, depending on conditions of delivery. For a good-sized contract on second-half delivery a very low price, doubtless, could be made. Inquiries continue numerous for second-half tonnage.

The steadiness of Northern iron compared with Southern is noteworthy. Iron from local furnaces has a fairly assured market for special purposes, as has Northern charcoal, which sells at $19.50@20 in the small lots demanded.

Iron and steel products find slightly improving conditions from week to week, railroad supplies, plates, bars and sheets being in good demand and structural material quiet. Coke is stationary, the best Connellsville bringing $4.75@4.85, Chicago.

Philadelphia

April 7—The pig-iron market is still in a depressed condition. Foundrymen will not buy much ahead, as they are still looking for bottom prices to come. The only people who seem to want much iron just now are the cast-iron pipe makers, and they want it cheap. Southern furnaces have further demoralized the trade by their hunt for orders at any price.

Steel Billets—Nothing doing, as buyers are looking for lower prices still.

Bars—Some large orders are reported placed at low prices. Store trade is much better than a month ago.

Structural Material—Business is active. Some large contracts are being talked over and will be placed soon, as low prices have been named. Small orders are coming in, making up a big total. Everybody seems to be getting ready to build.

Nails—The demand for nails and other supplies for small building is increasing fast, indicating a lot of work in that line.

Scrap—Dealers are on the hunt for customers. Most of them are pretty well loaded, and are anxious to get rid of some of the stock they are carrying. Buyers, for the most part, are in no hurry. Between the two prices are demoralized.

Pittsburg

April 6—A large volume of new business has been placed during the past few days and some important contracts are about to be closed. Orders so far have been for small tonnages only, but the aggregate has been large, and some interests have increased their production. The Republic Iron and Steel Company is operating all of its plants in the Youngstown district this week and today blew in No. 2 furnace of the Hazleton group, the other two having been in operation for several months. The company's Hannah furnace at Youngstown, is scheduled to go in blast next week. This will practically double the company's pig-iron production in the North and indicates a rapidly increasing trade in finished iron and steel products. It was intimated by the representative of a large steel interest today that several large contracts for structural steel, plates, merchant pipe and rails are to be awarded within a few days. Despite the low prices established on Feb. 19, there has been considerable shading by independents while the Steel Corporation subsidiary companies have been strictly adhering to the rates. It is now planned, according to reports, for the Corporation to go after all business, quoting below the lowest prices named by independent producers. The leading bar-iron producer has cut the price of iron bars $1 a ton and is now quoting 1.35c., Pittsburg, and is strictly observing the 1.20c. rate for merchant-steel bars. For western shipments prices are lower than heretofore quoted, but all western orders are supplied from mills in the Chicago territory. The wire concerns are not booking much new business as former prices are being quoted and jobbers and large consumers are so confident that prices will be cut that they are keeping out of the market, buying only for urgent needs. The National Tube Company continues to operate its plants in the Pittsburg district at about 80 per cent. and is still booking new business.

Pig Iron—The only new business of importance was the closing of a contract for 3600 tons of chill-cast bessemer by the Crucible Steel Company of America. The price is not given; the iron will be supplied by the Carnegie Steel Company from the Clairton furnaces. The Carnegie Steel Company blew in another Edgar Thomson blast furnace, the eighth of the group of 11, and is now operating 36 of its 59 blast furnaces. The bessemer average for March was $15.437, Valley furnaces, a decline of $0.438 from the previous month. The basic average was $14.937, Valley, a decline of 25c. Pig-iron quotations are nominal as follows: Standard bessemer, $15@15.25; malleable bessemer, $14.50@14.75; basic and No. 2 foundry, $14.50; gray forge, $13.50, all at Valley furnaces; freight to Pittsburg district, 90c. per ton.

Steel—Billet sales at the established price of $23, Pittsburg, are few and reports that this price is being shaded cannot be confirmed. Sheet-bars are quoted at $25.50, delivered, but sales have been made lower. Merchant-steel bars are still 1.20c., and plates, 1.30c.

Sheets—Prices are firm and some new business is being booked. Black sheets are 2.30c. and galvanized 3.30c. for No. 28 gage.

Ferro-Manganese—Prices are a trifle higher; $43.50@44 is quoted for prompt delivery at Pittsburg.

Foreign Trade in Iron and Steel

Iron and Steel Exports—Exports of iron and steel, including machinery, from the United States for the two months ended Feb. 28 are valued by the Bureau of Statistics of the Department of Commerce and Labor at $27,531,617 in 1908, and $21,276,547 in 1909: a decrease of $6,255,040, or 22.7 per cent. Leading items of export, in long tons:

	1908.	1909.	Changes.	
Pig Iron	4,222	5,962	I.	1,740
Billets, ingots & blooms	27,008	15,954	D.	11,054
Bars	9,499	9,889	I.	390
Rails	25,254	33,764	I.	8,510
Sheets and plates	16,480	19,891	I.	3,411
Structural steel	20,407	15,813	D.	4,594
Wire	23,300	20,115	D.	3,185
Nails and spikes	7,990	8,353	I.	363
Pipe and fittings	15,531	16,981	I.	1,450

The increases and decreases in these quantities were almost evenly divided.

Iron and Steel Imports—Imports of iron and steel and of machinery into the United States two months ended Feb. 28 were valued at $3,774,291 in 1908, and $3,628,746 in 1909; decrease, $145,545, or 3.9 per cent. Leading articles of import were, in long tons:

	1908.	1909.	Changes.	
Pig iron	23,418	20,643	D.	2,775
Scrap	1,076	1,064	D.	12
Ingots, blooms, etc.	1,107	2,018	I.	911
Bars	8,009	3,653	D.	4,356
Wire-rods	2,066	1,834	D.	232
Tinplates	10,201	7,463	D.	2,738
Sheets and plates	470	502	I.	32

The only increases this year were small ones in sheets and in ingots and blooms.

Iron Ore Movement—Imports and exports of iron ore in the United States, two months ended Feb. 28, long tons:

	1908.	1909.	Changes.	
Imports	137,753	166,982	I.	29,229
Exports	10,984	11,799	I.	815

Of the imports this year 114,205 tons were from Cuba; the balance from Newfoundland and Spain.

Imports of manganese ore, two months ended Feb. 28, were 53,713 tons in 1908, and 35,060 in 1909; decrease, 18,653 tons.

Metal Market

New York, April 7—The metal markets show some degree of improvement, but no considerable changes for the week.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Feb. 1909..	$ 8,860,814	$ 3,576,413	Exp. $5,284,401
" 1908..	1,967,597	2,847,133	Imp. 879,536
Year 1909..	16,726,170	6,996,596	Exp. 9,729,574
" 1908..	2,411,797	13,646,617	Imp. 11,234,820
Silver:			
Feb. 1909..	4,852,549	3,508,881	Exp. 1,343,668
" 1908..	4,108,774	3,451,75[illegible]	" 657,019
Year 1909..	9,394,643	7,173,63[illegible]	" 2,221,020
" 1908..	8,256,918	7,073,62[illegible]	" 1,183,289

Exports from the port of New York, week ended April 3: Gold, $544,000, to London and Argentina; silver, $806,556, to London and Paris. Imports: Gold, $110,456, from Central and South America; silver, $78,592, from South America and Mexico.

Treasury Department estimate of the amount and kinds of money in the United States on April 1:

	In Treasury.	In Circul'n.
Gold coin (inc. bullion in Treasury)	$ 192,511,528	$ 608,292,659
Gold certificates	47,661,660	796,956,209
Silver dollars	8,814,297	71,682,515
Silver certificates	6,607,037	476,757,963
Subsidiary silver	25,957,101	127,887,934
Treasury notes of 1890	11,193	4,386,807
U. S. notes	7,552,169	339,128,847
Nat. bank notes	22,816,033	661,591,582
Total	$311,931,018	$3,086,684,516
Total, April 1, 1908		3,080,450,734

Population of the United States April 1, 1909, estimated at 88,567,000; circulation per capita, $34.85. In addition to amount in Treasury the Government has $58,152,737 on deposit in National banks.

Gold—No change in prices in the open market in London is reported, quotations being 77s. 6d. per oz. for bars and 76s. 4d. for American coin. Most of the gold offered this week was taken by the Austrian government, presumably for use in its settlement with Turkey.

Platinum—Dealers quote $23@24 per oz. for refined platinum, $26 for hard metal and $19@21 for scrap. Business is improving and sales are freer than they have been.

Silver—The market appears to have reached a period of dullness, with no special inquiry or speculative tendency in sight. It does not look as if any great fluctuation in price were liable to happen at present.

SILVER AND STERLING EXCHANGE

Apr.	1	2	3	5	6	7
New York....	50½	50⅝	50⅞	51	50⅝	50⅞
London.....	23¼	23⅜	23 7/16	23⅜	23⅜	23 7/16
Sterling Ex..	4.8760	4.8760	4.8780	4.8770	4.8770	4.8780

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, reported by Messrs. Pixley & Abell, year to March 25:

	1908.	1909.	Changes.
India.....	£ 1,753,238	£1,083,000	D. £ 670,238
China.....	501,400	657,000	I. 155,600
Straits.....	78,270	82,800	I. 4,530
Total.....	£ 2,332,908	£1,822,800	D. £ 510,108

Receipts for the week, £5000 from the West Indies and £175,000 from New York; £180,000 in all. Exports, £165,000 to India.

Copper, Tin, Lead and Zinc

Apr.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
1	12⅞ @13	12⅜ @12⅝	57⅝	29⅜	4.10	3.95	4.60 @4.62½
2	12⅞ @13	12⅜ @12⅝	57¼	29⅜	4.10	3.95	4.60 @4.65
3	12⅞ @13	12⅜ @12⅝	....	29⅜	4.10	3.95	4.60 @4.65
5	12⅞ @13	12⅜ @12⅝	57⅜	29¼	4.10	3.95	4.62½ @4.67½
6	12⅞ @13	12⅜ @12⅝	57½	29⅜	4.10	3.95	4.62½ @4.67½
7	12⅞ @13	12⅜ @12⅝	57¼	29¼	4.10	3.95	4.65 @4.67½

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—Although business has quieted down, the market has not lost any ground during the week. It is generally recognized that consumption the world over is slowly, but surely, increasing, and that the disparity between supply and demand is proportionately diminishing. All of the agencies are offering electrolytic freely at 12¾c., delivered, 30 days, which is equivalent to a little less than 12⅝c., cash, New York, and this price has been shaded a little on transactions. The close is steady and unchanged at 12⅞@13c. for Lake copper; 12½@12⅝c. for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper is 12⅜@12½ cents.

Copper sheets are 16½c. base for large lots. Full extras are charged, and higher prices—up to 18c.—for smaller quantities. Copper wire, 14¼c. base, carload lots at mill

The London market has shown a firm undertone during the week, fluctuating within narrow limits. The close is steady at £57 5s. for spot, £57 17s. 6d. for three months standard.

Statistics for the second half of March show a decrease in the visible supplies of 1000 tons.

Refined and manufactured sorts we quote: English tough, £61 10s.; best selected, £60 10s.@61 10s.; strong sheets, £72 10s.@74 10s.

Copper exports as reported by the Bureau of Statistics for the two months ended Feb. 28 were 36,542 long tons; for March they are estimated at 21,160 tons, making a total of 57,702 tons for the three months.

Stocks of copper usually included in visible supplies were, on April 1: Great Britain, 37,930 long tons; France, 5920; afloat from Chile and Australia, 7500; total, 51,350 tons, a decrease of 1020 tons from the March 15 report.

Tin—The transactions in the London market have become smaller and the tone somewhat softer than it was during last week. Quotations have declined somewhat and close at £133 2s. 6d. for spot, £134 2s. 6d. for three months.

Some business was done in the domestic market by speculators, presumably for London account, but the demand on the part of consumers, especially for forward delivery, still leaves much to be desired. Spot metal at the close can be bought at about 29¼c. per pound.

Statistics for the month of March show an increase in the visible supplies of 100 tons.

Lead—Business continues in fair volume at 3.95c. St. Louis, 4.10c. New York.

The London market has been rather easier this week, the close being cabled at £13 8s. 9d. for Spanish lead, £13 11s. 3d. for English lead.

Spelter—There is a great deal of reluctance on the part of sellers to part with their metal at present prices, due to the proposed tariff on zinc ores. It took only a slightly better inquiry to affect prices, and though the orders placed were relatively of small volume, the market has advanced at the close to 4.80@4.82½ New York, 4.65@4.67½ St. Louis.

Quotations for spelter in New York, April 1, were 4.75@4.77½c.; 2 and 3, 4.75 @4.80c.; 5 and 6, 4.77½@4.82½c.; 7, 4.80 @4.82½ cents.

Base price of sheet zinc is now 6¾c. per lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

The London market is unchanged at £21 7s. 6d. for good ordinaries, £21 12s. 6d. for specials.

According to a newspaper report, the earnings of the Lanyon-Starr Smelting Company in 1908 were about 4 per cent. on its preferred stock of $250,000.

Other Metals

Antimony—Business continues extremely dull. In the absence of sales prices are nominally unchanged at 8c. per lb. for Cookson's, 7¾c. for Hallett's, and 7½c. for ordinary brands.

Aluminum—Quotations are unchanged at 22@24c. base for No. 1 ingots; 33@34c. base for sheets.

Quicksilver—The market in New York is quiet and unchanged at $45@46 per flask of 75 lb. San Francisco prices are nominal at $44@45 for domestic orders, and $2 less for export. The London quotation has been reduced 5s., and is now £8 2s. 6d. per flask.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, spot, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. The price for electrolytic is 5c. higher.

Cadmium—Current quotation 75c. per lb., in 100-lb. lots, at Cleveland, Ohio.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

Imports and Exports of Metals

Exports and imports of metals in the United States, two months ended Feb. 28, are reported as follows, in the measures usual in the trade:

Metals:	Exports.	Imports.	Excess.
Copper, long tons	36,542	21,401	Exp. 15,141
Copper, 1908	59,352	14,312	Exp. 45,040
Tin, long tons	56	5,938	Imp. 5,882
Tin, 1908	60	3,212	Imp. 3,152
Lead, short tons	13,840	17,958	Imp. 4,118
Lead, 1908	17,195	18,266	Imp. 1,071
Spelter, sh. tons	732	761	Imp. 29
Spelter, 1908	255	34	Exp. 221
Nickel, lb.	1,490,116	2,163,266	Imp. 673,150
Nickel, 1908	2,182,566	2,599,997	Imp. 417,431
Antimony, lb.	.....	1,172,524	Imp. 1,172,524
Antimony, 1908	.....	1,574,237	Imp. 1,574,237
Platinum, oz.	.....	21,841	Imp. 21,841
Platinum, 1908	.....	5,124	Imp. 5,124
Quicksilver, lb.	8,878	.....	Exp. 8,878
Quicksilver, '08	31,430	.....	Exp. 31,430
Aluminum, value	$11,575	.....	Exp. $11,575
Aluminum, 1908	10,722	.....	Exp. 10,722
Ores, etc.:			
Zinc oxide, lb.	4,067,281	.....	Exp. 4,067,281
Zinc oxide, '08	3,200,287	.....	Exp. 3,200,287
Zinc dross, lb.	2,259,462	.....	Exp. 2,259,462
Zinc dross, '08	5,066,965	.....	Exp. 5,066,965
Zinc ores, lg. tons	.....	13,242	Imp. 13,242
Zinc ores, 1908	6,067	6,285	Imp. 218
Antim'y ores, lb.	504	2,366,385	Imp. 2,365,881
Ant. ores, 1908	.....	121,603	Imp. 121,603
Chrome ore	.....	6,801	Imp. 6,801
Chrome ore, '08	.....	.....	.....

Copper, lead and nickel include the metal contents of ores, matte, bullion, etc. The exports given include reëxports of foreign material. Imports of zinc ores in 1909 included 2929 tons calamine and 10,313 tons other ores, against 3648 and 2637 tons, respectively, last year. Chrome ore was not reported last year.

Zinc and Lead Ore Markets

Platteville, Wis., April 3—The highest price paid this week for zinc ore was $39; the base price for 60-per cent. zinc was $37.50@38 per ton. For 80-per cent. lead ore, $49 per ton was paid.

SHIPMENTS, WEEK ENDED APR. 3

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Hazel Green	334,600	.....	.....
Linden	288,290	.....	.....
Benton	252,240	.....	.....
Livingston	240,000	.....	.....
Cuba City	175,400	.....	.....
Platteville	173,050	88,000	160,000
Total	1,463,580	88,000	160,000
Year, to Apr. 3	25,241,934	627,580	2,429,850

In addition to the above there was shipped to the American Zinc Ore Separating Company 273,300 lb., and to the Joplin Separator Works, 174,600 lb. zinc concentrates.

Joplin, Mo., April 3—The highest price reported was $41.50 per ton for sulphide zinc ore assaying 63.5 per cent. zinc sold on a $38 base. Additional sales were made this week on a $38 base, and the bulk of the large purchases were made on a $37.50-base price, with a less amount selling at $37@36.50 base, and but a few scattering lots on a $36 base. Zinc silicate ore was lower in price, with no competition, very nearly all the purchases being on a base of $17 per ton of 40-per cent. zinc, with a few on an $18 base. The highest reported was, however, $25 for one bin assaying 47 per cent. on an $18 base. The general high price was $20@21. The average price, all grades, was $34.58. Lead continues upward, with offerings as high as $55, an advance of $1.50 per ton. The base price was generally $54 per ton of 80-per cent. lead. The average price, all grades, was $52.82 per ton.

The week's shipment foots up the second largest total tonnage of the year, in zinc, some of the large purchases of two and three weeks ago being loaded out. The car situation has been troublesome, but is better now.

SHIPMENTS, WEEK ENDED APR. 3

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	4,037,380	844,910	$ 97,200
Joplin	1,968,320	301,340	44,255
Badger-Beacock	1,114,430	74,350	22,903
Galena	630,940	244,140	18,286
Duenweg	898,420	79,660	16,900
Alba-Neck	658,040	5,720	12,650
Aurora	566,240	.....	7,924
Spurgeon	444,540	78,850	6,786
Granby	439,000	18,000	6,350
Prosperity	479,630	40,400	6,273
Miami	370,040	.....	5,735
Zincite	256,380	21,750	5,329
Carthage	272,890	.....	5,184
Quapaw	234,030	20,450	4,285
Oronogo	258,090	.....	3,613
Sarcoxie	137,270	.....	2,538
Carl Junction	72,960	.....	1,423
Ash Grove	.....	45,350	1,224
Stott City	44,650	.....	803
Cave Springs	33,210	.....	631
Totals	12,916,470	1,774,920	$270,292
Fourteen weeks	156,365,070	24,324,640	$3,418,135
Zinc value, the week, $223,400; 14 weeks, $2,795,975			
Lead value, the week, 46,892; 14 weeks, 622,160			

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February	36.63	36.94	34.92	34.37	49.72	50.50
March	36.19	37.40	34.19	34.71	49.90	50.82
April	35.40	.....	34.08	.....	52.47	.....
May	34.19	.....	33.39	.....	56.05	.....
June	33.06	.....	32.07	.....	60.48	.....
July	34.55	.....	31.67	.....	59.90	.....
August	36.53	.....	33.42	.....	60.34	.....
September	37.63	.....	34.44	.....	54.59	.....
October	35.95	.....	33.28	.....	52.63	.....
November	39.13	.....	35.02	.....	54.53	.....
December	42.75	.....	39.63	.....	49.68	.....
Year	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, April 6—The chemical market is exceptionally dull and inactive.

Copper Sulphate—Prices are at a standstill at $4.60 per 100 lb. in carload lots and $4.85 per 100 lb. for smaller quantities.

Arsenic—White arsenic is now quoted at 2⅞c. per lb. A dull market prevails.

Nitrate of Soda—The market is exceptionally dull and heavy. Prices are 2.15@2.17c. for both spot and futures.

The position of nitrate in the United States on April 1 is reported as follows, in long tons, by Messrs. Mortimer & Wisner, New York:

	1908.	1909.	Changes.
Stocks, Jan. 1	5,900	9,140	I. 3,240
Imports 3 months	53,300	104,800	I. 51,500
Total Supplies	59,200	113,940	I. 54,740
Deliveries 3 months	51,650	99,990	I. 48,340
Stocks, Apr. 1	7,550	13,950	I. 6,400
Afloat for U. S.	80,000	60,000	D. 20,000

Quantities afloat include all cargoes due to arrive at United States ports before July 15 next.

Phosphates—Exports of Florida phosphates through the port of Savannah in February are reported by J. M. Lang & Co., at 5025 tons, all to Germany.

Imports and Exports—The imports and exports of chemicals and raw materials in the United States, two months ended Feb. 28, were as follows:

	Imports.	Exports.	Excess.
Copper sulph. lb.	.....	1,318,978	E. 1,318,778
Bleach, lb.	12,814,773	.....	I. 12,814,773
Potash salts, lb.	69,318,942	1,108,105	I. 68,210,837
Soda salts, lb.	2,055,204	94,002	I. 1,961,202
Acetate lime, lb.	.....	16,704,200	E. 16,704,200
Nit. of soda, tons	41,254	1,035	I. 40,219
Phosphates, tons	425	119,005	E. 118,580
Sulphur, tons	4,762	6,537	E. 1,775
Pyrites, tons	93,946	.....	I. 93,946

Exports include reëxports of foreign material. Estimating sulphur contents of pyrites, the total sulphur imported was approximately 42,340 long tons.

Mining Stocks

New York, April 7—The general stock markets throughout the week have shown a good deal of strength and prices have advanced with only some slight reaction. The bull market seems to be pretty well established for the present.

There have been all sorts of rumors about the expected decision of the Supreme Court on the commodities clause, but these seem to have been without foundation and were doubtless circulated for the purpose of depressing certain stocks.

On the Curb the copper stocks were generally strong and in good demand, but fluctuations were not very large in amount. There were heavy sales of Nevada Consolidated and one or two other stocks at slight advances in prices. The Nevada gold stocks were only moderately

active, but held their own so far as quotations were concerned. There is a good deal of interest in the Cobalt stocks and a little boom in them is rather expected.

Boston, April 6—Sentiment continues optimistic regarding the mining-share market, although it is not accompanied to any great extent by extended market operations. Prices as a rule are higher in the week's time, but activity has been confined to a few specialties.

Activity in the share market has been speculative, and is in those stocks in which pool manipulation has entered to a large extent. Conspicuous have been Arizona Commercial and Lake. The former rose $4.25 to $43.25. This company's 6-per cent. convertible bonds realized $175, which is a new high record. Lake Copper rose over $2 to $19 on insistent buying by brokers with Michigan connections. Mass Mining sold up over $2 to $8.12½, owing to developments at the mine.

Amalgamated has advanced $3.50 to $77.50. North Butte is slightly lower for the week closing at $71. The market movements of this stock are not understood, but presumably are manipulative and for the purposes of accumulating the stock. Copper Range rose $1.50 to $78. Conspicuous declines are $1.50 for Old Dominion to $51.25, $1.25 for U. S. Smelting at $41.75, and less than $1 for Utah Consolidated to $41.75.

Curb operations have been quiet and prices are slightly lower for the week.

STOCK QUOTATIONS

NEW YORK	Apr. 7	BOSTON	Apr. 7
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Mine	.51	Adventure	8
Amalgamated	76½	Alloues	39½
Anaconda	44¾	Am. Zinc	25¼
Balaklala	‡2 1/16	Arcadian	5
British Col. Cop.	7	Arizona Com	43¼
Buffalo Mines	3¼	Atlantic	12¾
Butte Coalition	25¼	Boston Con	12¾
Colonial Silver	⅛	Calumet & Ariz.	101¼
Cum. Ely Mining	7¾	Calumet & Hecla	625
Davis Daly	5⅛	Centennial	31
Dominion Cop.	12½	Con. Mercur	‡.28
Douglas Copper	2¾	Copper Range	78
El Rayo	2½	Daly-West	10¾
Florence	3/16	East Butte	14½
Foster Cobalt	.34	Franklin	16¾
Furnace Creek	.11	Greene—Can	10¾
Giroux	8½	Isle Royal	26
Gold Hill	⅛	La Salle	15
Goldfield Con	8⅛	Mass	7⅞
Granby	96	Michigan	12¾
Greene Gold	¼	Mohawk	62½
Greene G. & S.	7	Nevada	20¾
Guanajuato	1⅛	North Butte	72⅛
Guggen. Exp.	175	Old Colony	.60
Hanapah	.15	Old Dominion	52½
Kerr Lake	7⅞	Osceola	131
McKinley Dar.	.99	Parrot	33½
Miami Copper	14⅞	Quincy	89
Micmac	1½	Rhode Island	‡¾
Mines Co. of Am.	⅛	Santa Fe	2⅛
Mitchell Mining	⅛	Shannon	14⅞
Mont. Sho. C.	1½	Superior	42
Nev. Utah M. & S.	2⅞	Superior & Pitts.	13⅞
Newhouse M. & S.	3¾	Tamarack	77⅛
Nipissing Mines	10¾	Trinity	14½
Old Hundred	⅛	United Cop., com.	‡12½
Silver Queen	.49	U. S. Oil	32¾
Stewart	¾	U. S. Smg. & Ref.	41¾
Tennessee Cop'r.	40½	U.S. Sm. & Re., pd.	44¾
Tri-Bullion	1 1/16	Utah Con	41¾
Union Copper	1/16	Victoria	4¾
Utah Apex	6⅛	Winona	5¾
Utah Copper	43¼	Wolverine	145
Yukon Gold	4 7/16	Wyandotte	2¾

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	37⅛
Am. Smelt. & Ref.	89⅛
Am.Sm. & Ref., pf.	104⅝
Colo. Fuel & Iron.	36½
Federal M. & S., pf.	82½
National Lead	84¼
National Lead, pf.	107⅞
Pittsburg Coal	‡10¼
Republic I. & S.	22⅝
Republic I. & S., pf.	74¾
Sloss-Sheffield	74⅛
Standard Oil	669
U. S. Steel	50¾
U. S. Steel, pf.	113¾
Va. Car. Chem.	44½

BOSTON CURB	Low.
Ahmeek	140
Black Mt.	97
Chemung	19
Globe Con	4⅛
Hancock	11
Helvetia	2¾
Keweenaw	‡4¾
North Lake	‡7¼
Ojibway	12⅞
Ray Con	14⅛
Superior & Bost.	‡15⅛

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS	Apr. 3		
N. of Com.	High.	Low.	
Adams	.40	.30	
Am. Nettie	.05	.03	
Center Cr'k	1.60	1.30	
Cent.C.& C.*	83.00	82.00	
C.C. & C. pd.	80.00	79.00	
Cent. Oil	110.00	100.00	
Columbia	8.00	5.00	
Con. Coal	20.00	19.00	
Doe Run	110.00	100.00	
Gra. Bimet.	.20	.17	
St. Joe	12.00	11.00	

LONDON	Apr. 7		
Name of Com.	Clg.		
Dolores	£1	5s	0d
Stratton'sInd.	0	2	9
Camp Bird	0	16	0
Esperanza	3	0	0
Tomboy	0	18	9
El Oro	1	5	0
Oroville	0	10	3

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Apr. 7.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.14
Belcher	.47	St. Ives	.13
Best & Belcher	.35	Triangle	.01
Caledonia	.20	BULLFROG STOCKS	
Challar	.09	Gibraltar	.03
Comstock	.26	Homestake King.	.03
Con. Cal. & Va.	.67	Mont. Shoshone C.	1.37½
Crown Point	‡.36	Tramp Cons	.04½
Exchequer	.07	MISCELLANEOUS	
Gould & Curry	.10	Bonnie Clare	...
Hale & Norcross	.16	Lee Gold Grotto	...
Mexican	.57	Nevada Hills	1.25
Ophir	1.05	Nevada Smelting.	1.00
Overman	‡.12	Nevada Wonder	.75
Potosi	.11	Nevada-Utah	2.81½
Savage	.12	Penn-Wyoming	.02
Sierra Nevada	.23	Pittsburgh S. Pk.	.65
Union	.11	Rawhide Caol't'n.	...
Utah	.03	Round Mt. Sphinx	.10
Yellow Jacket	‡.64		
TONOPAH STOCKS			
Belmont	.93		
Extension	.53		
Golden Anchor	...		
Jim Butler	.17		
MacNamara	.30		
Midway	.24		
Montana	.69		
North Star	.03		
Tono'h Mine of N.	6.50		
West End Con	.30		
GOLDFI'D STOCKS			
Adams	.02		
Atlanta	.12		
Blue Bell	.04		
Booth	.20		
Columbia Mt.	.12		
Comb. Frac.	1.15		
Con. Red Top	.07		
Cracker Jack	.03		
Dia'dfield B. B. C.	.06½		
Goldfield Belmont	.04		
Goldfield Daisy	.46½		
Great Bend	.17		
Jumbo Extension	.19		
Kendall	.06		
Lone Star	.04		
May Queen	.03		
Oro	.10		
Red Hill	.10		
Roanoke	...		
Sandstorm	.12		

COLO. SPRINGS	Apr. 2		
Name of Comp.	Clg.		
Acacia	.06¼		
Black Bell	....		
C. C. Con	.03¾		
Dante	.06		
Doctor Jack Pot	.09		
Elkton	.69		
El Paso	.46		
Findlay	.14¾		
Gold Dollar	.11½		
Gold Sovereign	‡.03		
Isabella	.24		
Index	....		
Jennie Sample	.07⅝		
Jerry Johnson	‡.06¾		
Mary McKinney	.38		
Pharmacist	.03		
Portland	.90		
Un. Gold Mines	.04¾		
Vindicator	.76		
Work	.07¼		

Assessments

Company.	Delinq.	Sale.	Amt.
Alameda, Ida	Mar. 10	Apr. 10	$0.05
Blackjack Con., Utah	Apr. 15	May 7	0.01
Cedar Creek, Ida	Mar. 3	Apr. 5	0.003
Challenge Con., Nev	Mar. 19	Apr. 9	0.00½
Comet G. & C., Ida	Mar. 20	Apr. 20	0.001
Con. Cal. & Va., Nev	Mar. 23	Apr. 13	0.25
Crown Point, Nev	Apr. 18	Apr. 28	0.10
Gov't Gulch, Ida	Mar. 9	Apr. 9	0.001
Hypotheek, Ida	Mar. 11	Apr. 12	0.005
Imlay, Nev	Apr. 6	Apr. 28	0.03
Mexican, Nev	Apr. 8	Apr. 29	0.10
Mineral Farm, Ida	Mar. 12	Apr. 10	0.003
N. Y. Bonanza, Utah	Apr. 7	Apr. 28	0.03
North Franklin, Ida	Mar. 15	Apr. 15	0.005
Reliance, Ida	Mar. 23	Apr. 20	0.001
Rexall S. & C., Utah	Mar. 26	Apr. 25	0.01½
Savage, Nev	Apr. 8	May 5	0.10
Silver King Con., Utah	Mar. 29	Apr. 14	0.10
Spanish Ridge, Cal	Feb. 11	Apr. 10	0.03
Union Con., Nev	Apr. 8	Apr. 30	0.10
Yellow Jacket, Nev	Mar. 17	Apr. 24	0.15

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1908.	1909.	1908.	1909.
January	55.678	51.750	25.788	23.834
February	56.000	51.472	25.855	23.706
March	55.365	50.468	25.570	23.227
April	54.505	.....	25.133	.....
May	52.795	.....	24.377	.....
June	53.663	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.769	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1908.	1909.	1908.	1909.	1908.	1909.
January	13.726	13.893	13.901	14.280	62.386	57.688
February	12.905	12.949	13.008	13.295	58.786	61.197
March	12.704	12.387	12.875	12.826	58.761	56.231
April	12.743	.....	12.928	.....	58.331	.....
May	12.598	.....	12.788	.....	57.387	.....
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.989	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	28.290	August	29.942	.....
March	30.577	28.727	September	28.815	.....
April	31.702	.....	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. year	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis	London.	
	1908.	1909.	1909.	1908.	1909.
January	3.691	4.175	.....	14.469	13.113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	3.986	3.835	13.975	13.438
April	3.993	.....	.....	13.469	.....
May	4.253	.....	.....	12.938	.....
June	4.466	.....	.....	12.600	.....
July	4.447	.....	.....	13.000	.....
August	4.580	.....	.....	13.375	.....
September	4.515	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	4.889	4.638	4.739	20.875	21.563
March	4.665	4.757	4.527	4.607	21.075	21.438
April	4.645	.....	4.495	.....	21.344	.....
May	4.608	.....	4.458	.....	19.906	.....
June	4.543	.....	4.393	.....	19.000	.....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November	5.059	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.